RAPIDC

Regional Air Pollution In Developing Countries

Programme on Regional Air Pollution in Developing Countries (RAPIDC)

Annual Report

May 2006 - April 2007

Prepared by the

Programme Management Committee (PMC) comprising SEI, UNEP RRC.AP, SACEP, IES and UNZA

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Executive Summary

This is the second Annual Report of the Regional Air Pollution in Developing Countries (RAPIDC) Programme Phase III, co-ordinated by the Stockholm Environment Institute (SEI) and funded by Sida. It has been written by the RAPIDC Programme Management Committee (PMC), comprising SEI, UNEP Regional Resource Centre for Asia and the Pacific (RRC-AP), the South Asia Cooperative Environment Programme (SACEP), the Institute on Environmental Studies (IES), University of Zimbabwe, and the University of Zambia (UNZA). This is a three-year phase covering the period May 2005 – April 2008. RAPIDC is currently divided into three main focus areas: implementation of the Malé Declaration in South Asia, development of the Air Pollution Information Network for Africa (APINA) activities in southern Africa, and development of four different air pollution networks active in Asia, Africa and internationally.

The overall objective of RAPIDC is to contribute to solving air pollution problems in the key regions of interest (South Asia plus Iran, and southern Africa). RAPIDC aims to achieve this overall objective through its Programme Purpose which is '*to facilitate the development of agreements and/or protocols to implement measures which prevent and control air pollution through promoting international cooperation and developing scientific information for the policy process*'.

From European experience, the development of regional agreements on air pollution can act as a powerful stimulus for progress in developing air pollution prevention and control strategies, within countries and across whole regions. In contrast, nearly all policy development in Asia and Africa is at national and local, urban scales. This does not allow transboundary issues to be tackled and also hinders development of coherent policies across regions that can solve some of the local or national-scale problems. To move from a situation where countries are setting up air pollution policies in isolation to one where the policy development is regionally coordinated, requires a framework within which countries can develop such arrangements.

Thus, the following are required: i) a framework for regional cooperation; ii) activities that build the capacity and supply the methods to develop the scientific knowledge about air pollution from local to regional scales, and its potential transboundary impacts; iii) results showing the extent of regional air pollution, transboundary transport and associated impacts; iv) an intergovernmental process by which agreements and protocols can be developed on the basis of proven need regarding shared and/or transboundary air pollution problems, and v) regional policy development with national and regional commitments.

The role of RAPIDC within this policy development context is to promote the development of regional cooperation and undertake activities and develop/refine methods to build capacity to understand the different air pollution problems and come up with the results that can inform the development of regional policies and agreements, and demonstrate their necessity.

Frameworks for regional cooperation

In both South Asia, through the Malé Declaration, and in southern Africa, through APINA, frameworks for regional cooperation are in place, thanks in large part to the activities undertaken under the RAPIDC programme.

There is a focus in the Malé Declaration on building the scientific basis for agreements and ensuring that there is active involvement of the policy makers in the ministries of environment of each country (the National Focal Point or NFP). The Malé Declaration provides a regional forum to discuss the

further development of protocols and other such policy interventions but does not encompass this level of ambition within the Declaration itself. This made it easier for the countries to agree to cooperate and, once the scientific information starts to flow more regularly, it is anticipated that the policy discussions in the region will follow

The regional network development has been strengthened in a number of ways. The main result in 2006 is associated with the annual Intergovernmental Meeting of the NIAs, NFPs and other Malé stakeholders which held its Eighth Session (IG8) in Thimpu, Bhutan, in September 2006. It was chaired by a Minister from Bhutan which is a first for the intergovernmental meeting of the Declaration and is in line with the request of IG7 for higher level participation from national focal points. At this meeting the countries have control of the development of the Malé Declaration. An evaluation of the Malé process, which was tabled at the meeting, has consulted the governments and stakeholders through questionnaires on the possibility of devising a Protocol for the Malé Declaration. Based on the results, the IG8 has decided that the discussions on a protocol can be initiated after data flow from the monitoring stations has been checked and analysed.

Further recommendations from the meeting include the implementation of an extended institutional structure with lead country functions for specialist institutions and the establishment of long-term training programmes for smaller countries such as the Maldives. Internal auditing would be implemented to encourage the countries to follow the data reporting formats developed for the Malé Declaration and a data verification group would be formed from the National Advisory Committee to meet monthly for data verification. The existing South Asian Association for Regional Cooperation (SAARC) centres would be studied to examine their suitability for being assigned as technical centres for Malé Declaration. Care would be taken to ensure representation of the member countries in the different committees and task forces of the Malé Declaration.

Further development of the Malé network, promoting increased ownership by the countries, will be implemented during an Exchange Programme between the national level Project Managers (NIAs) and the Secretariat at UNEP RRC.AP. At this meeting, which will be held during May 2007, the planning for Phase IV will be initiated and the knowledge gained from Phase III activities will be assessed.

In Southern Africa, APINA is providing the framework for regional cooperation among the Southern African Development Community (SADC) countries on transboundary air pollution issues with seven of the 14 SADC countries currently engaged in RAPIDC activities. APINA creates a forum for scientists, policy makers from ministries of environment (the National Focal Points –NFPs), NGOs, the business community and civil society to discuss issues of air pollution with the ultimate aim of developing protocols and other policy interventions at national and regional levels. This is achieved nationally by holding national stakeholder's meetings attended by central and local government officials overseeing environmental, health, energy, industry and transport issues, and representatives of industry and civil society. The first national stakeholders meeting were held in 2005/2006 with the second round scheduled in mid 2007. These meetings convened by the NFPs are creating awareness within relevant government departments and within nations to put air pollution issues on the political agenda. They also serve to channel national view points to the regional policy process.

APINA has annual meetings where progress on the RAPIDC activities are discussed and steps towards protocol development are crafted with advice from the NFPs. In addition, APINA holds Policy Dialogues at regional level where science findings, packaged for policy makers are presented and discussed with policy makers so that they can form a basis for informed policy development. Since its inception APINA has held two regional policy dialogues (RPD); one in Harare in 1998, and

one in Maputo in 2003 with a third scheduled for February 2008 in Gaberone, Botswana. These dialogues have created a forum for discussion on the problem of regional transboundary air pollution in southern Africa. The outcome of the last RPD was a draft declaration, the *"Maputo Declaration on the Prevention and Control of Air Pollution in southern Africa and its Likely Transboundary Effects."* A strategy was developed to have the Draft Declaration endorsed by SADC ministers and to feed into the activities of the New Partnership for African Development (NEPAD). APINA has continued to further the adoption of the Maputo Declaration by holding a side event for Senior Advisors to the Ministers of Environment from SADC countries at the Better air Quality for Sub-Saharan African Cities 2006 Conference which was attended by representatives of 10 of the 14 SADC countries to set up the logical steps towards intergovernmental agreement on air pollution. This meeting agreed that the Maputo Declaration was a good basis for progressing towards an intergovernmental agreement on air pollution issues for the SADC region and that all SADC countries should be engaged in the process to achieve meaningful progress. Thus the next APINA annual meeting will see representatives from Ministries of Environment of the seven SADC countries that are currently not participating in APINA activities being invited.

APINA, by creating the framework for regional cooperation on air pollution in southern Africa has also promoted the development of regional protocols in the SADC region. APINA has had a memorandum of understanding with SADC to provide input on air pollution issues in the SADC Protocol on Environment. Recently the SADC secretariat has informed APINA that it is reviving the process of developing the protocol and has requested APINA to be a technical partner on the section on air pollution issues.

In partnership with UNEP-Partnership for Clean Fuel and Vehicles; World Bank – Clean Air Initiative in sub-Saharan Africa; SEI and USEPA, APINA organised the Regional Conference on Better Air Quality in sub-Saharan African Cities in July 2006 where 49 countries were represented with 30 Ministers of Environment present to discuss the issue of urban air pollution, its link to poverty, capacity building needs and the need to reduce or prevent emissions. As a follow-up to this conference discussions are underway with UNEP and the World Bank for APINA to host a regional workshop to develop policies on sulphur reduction in fuels in southern Africa.

Thus RAPIDC, through support for the implementation of the Malé Declaration and APINA work plan, is moving steadily along the path outlined in the Programme Purpose, namely 'to facilitate the development of agreements and/or protocols to implement measures which prevent and control air pollution....'. The exact timing of protocol formation or the eventual outcome of the process is not known and depends on factors outside of RAPIDC control, such as diplomatic relationships between countries and national priorities in the region. However, the science-policy discussions appear to be moving towards enhanced agreements in both regions.

Capacity building activities

It is difficult to develop comprehensive air pollution management policies at any scale without a reliable emission inventory. In the Malé and APINA countries no official emission inventory for regional air pollutants has previously been produced by the governments concerned. A suitable methodology for preparing emission inventories has now been developed and tested through RAPIDC and is being implemented by all Malé and APINA countries. There have been two training workshops and all Malé countries have begun to fill in the workbooks and deliver results for the emissions from different sectors and point sources in their countries. These are preliminary and the workbooks from most of the countries have been sent to the Secretariat and SEI for quality control. The emission inventory experts have also had training in scenario building including back-casting techniques at the

two meetings. The methods are being developed to link scenario building to the emission inventory workbooks.

In APINA, there have been two training workshops and a third is scheduled for Oct/Nov 2007. The training in emission inventories has been carried out for two people from each of the seven APINA countries – one from a government department and one from academia. This combination has proved very effective in linking universities with government representatives and progress in developing the emission inventories is good. First drafts of the national emission inventories (for the year 2000) have now been compiled by the task team members for all seven APINA countries.

At the urban scale the rapid urban assessment (RUA) emission inventory compilation methods are being applied in Kathmandu, following on from the successful pilot study in Hyderabad. The training has been taking place and the data gathered. The result will be a distributed emission inventory using a combination of a top-down emission inventory based upon the Malé manual, distributed using satellite imagery and bottom up data. APINA has decided that the same approach be implemented in Maputo and this is now up and running. The launch of RUA has contributed substantially to raising of awareness concerning urban air pollution in Mozambique. The project has been welcomed by the Maputo City Council and incorporated into the City's integrated strategy to improve the quality of the urban environment.

The transport of air pollutants once emitted can be determined through trajectory analysis and modelling. Atmospheric transport modelling is the only way to investigate the long distance and potential transboundary transport of air pollution, which is an important piece of knowledge for regional policy development. Atmospheric scientists, NFP and NIA representatives of the Malé Declaration have been trained in trajectory analysis methods and introduced to the concepts behind the MATCH atmospheric transport model of SMHI. The MATCH model is developing estimates of sulphur, nitrogen, $PM_{2.5}$ and ozone deposition and concentrations for the Malé region to investigate regional transport and allow deposition and concentration estimates to be made on the basis of recent emission estimates or scenarios.

In APINA, the CAMX model is being used by the Task Team on atmospheric transfer and is developing results to assess impacts in southern Africa. The first major deliverable is a comprehensive scoping study on the current modelling capabilities, the experience and the capacity in the various countries in the southern African region. This scoping study reveals that there is a dire shortage of qualified and experienced modellers in most southern African countries with the exception of Tanzania and South Africa. The report also explored the feasibility of establishing a centre for regional scale atmospheric transport modelling in a southern African country.

In Kathmandu, the TAPM model is being applied to the emission estimates and the resulting concentrations validated using passive samplers and other equipment for PM measurement. It is intended that modelling will also be performed in Maputo.

The estimates of atmospheric transport of different pollutants are only as good as the input data and model validity in the region. In order to test the model performance, the results need to be validated against monitoring data collected in regionally representative sites. In RAPIDC, the Composition of Asian Deposition (CAD) network has been producing data for remote, regionally representative sites in India of the highest international standard for both concentration of gases and aerosols and also for ions in rainwater. Trends in sulphate and nitrate concentrations show a significant increase in over the 20 years between 1985 and 2005 for both urban and rural sites in India. This is clear evidence of the worsening pollution situation in South Asia.

One of the major conclusions of the CAD research community is that acidification is not likely to be a serious concern during the next few decades in South, South-East and East Asia – except for some areas in SW China. This is due to the alkaline nature of most Asian soils that tend to neutralize the acids formed from the emissions of sulphur and nitrogen oxides. This conclusion is based both on results from the CAD network and on research carried out in co-operation with scientists at SEI/York (see acidification section below). This result is still tentative and has to be followed up by further investigations, in particular regarding the sensitivity of soils in different regions. The most important air pollution issues in the region are probably the aerosol/health and aerosol/climate issues and the impact of enhanced surface ozone on crops. The fundamental role of atmospheric aerosols for climate and health motivates an increased focus on aerosols in a possible future phase of the CAD program.

There is now a monitoring station in each country of the Malé Declaration in more remote, regionally representative sites where there were none before that were specifically linked to government. Results from these may be used to validate the results of the atmospheric transport models. The countries have placed a lot of effort in developing the monitoring sites, not without problems. All sites are now delivering data, but not all sites are delivering all data. For that reason a plan to ensure that all sites deliver regular data has been established and this is currently being implemented. The preliminary results can now be compared to the modelling results and these show good correlation in some cases and less good in others. This is the start of the emission-transport-monitoring inter-comparisons and validation that has been a key part of the development of the LRTAP Convention.

Despite a number of the monitoring efforts, there is currently no coordinated approach within APINA member countries for validation of the data or dissemination of the collected information for direct input into strategies addressing air pollution problems. An APINA scoping report is focusing on opportunities for APINA to collaborate with existing monitoring initiatives in the region, to fill gaps in knowledge and provide much needed monitoring data for air pollution impact studies. The aspiration is to be able to make high quality measurements of air pollutants that could be reliably compared across the region and this is being addressed in the plans for Phase IV.

The impacts of air pollution provide the impetus for policy development. The health impacts of air pollution are the major policy driver for decision makers in developing countries. There is generally limited knowledge and literature on the health impacts of air pollution in southern Africa and, although there is more activity in South Asia, information required to feed into the policy making process and to raise civic society awareness is lacking. Regional health assessment capacity has been strengthened through regional training workshops in Asia and Africa. For APINA, country papers and reports on existing relevant local data, and case studies on air pollution-related health impacts in member countries, have been compiled and training in health risk assessment has been provided. As part of the Malé implementation, a simple epidemiological study in Dhaka, Bangladesh, is being undertaken to demonstrate the impacts of air pollution on asthmatic children. The study has started and seems to be on track to deliver results. Other countries are also interested in undertaking similar studies (Pakistan has expressed an interest). A similar study had been proposed by APINA but could not be accommodated in the Phase III budget. It is proposed that the Task Team Leader for Health be involved in future meetings that discuss outcomes of the studies in Malé countries in preparation for carrying out similar studies in APINA countries in Phase IV.

The health capacity building project for the Malé Declaration and APINA has i) brought together regional expertise in medicine and air quality assessment from Bangladesh, Bhutan, Iran, Maldives, Nepal, Sri Lanka and Thailand in Asia, and Botswana, Malawi, Mozambique, South Africa, Tanzania, Zambia and Zimbabwe in southern Africa and provided courses and materials to the participants on simple methodologies in assessment of impacts of air pollution on health; ii) commenced collation of

regional information provided by the participants on studies conducted in their countries (to be completed by the end of this project); iii) discussed the regional issues, sources, ambient concentrations, control policies, impacts on health and implications for the region; and iv) discussed the information needs of decision-makers in the region, how the information can be obtained, methodologies, resources, and regional collaboration to provide the information required.

The impacts of air pollutants on crop yield, particularly by ozone concentrations, have been highlighted by training and a number of experiments and through use of the MATCH model in Asia. The results for the ozone calculations show that during the September to October period, which is the main growing season for many crops in South Asia, exceedance of the European critical level for wheat occurs over large parts of India as well as north-eastern Pakistan, much of Bangladesh and a large swathe of the Tibetan plateau. Adverse impacts could include a potential yield loss of up to 30%, assuming applicability of European derived dose-response relationships.

In APINA the CAMx model has been used to investigate the potential of transboundary ozone impacts on maize, a southern African staple crop. This work has been carried in collaboration with the South African Government funded Cross-border Air Pollution Impact Assessment (CAPIA) project, which was stimulated by the presence of APINA in the region. During this phase of RAPIDC, APINA is carrying out a collaborative case study between the modelling and the crop impact task teams to integrate ozone hotspot data with those derived from the bio-monitoring experiments (see below), which will include the use of IVL passive samplers for measurement of ambient ozone concentrations.

Under RAPIDC, the Air Pollution Crop Effects Network (APCEN) is coordinating a global network of scientists devising common approaches for experimental and modelling assessments. It is responsible for coordinating the pilot studies for the experiments being undertaken in Malé and APINA countries and is developing experimental protocols. The network of scientists has met in 2006 and another meeting is planned in 2008.

The Malé and APINA crop assessments currently being carried out in the regions include: i) growing clover clones, one sensitive and one insensitive to ozone, and measuring the difference in yield and ii) using EDU (ethylene diurea) which protects crop plants from ozone.

In APINA, six countries are participating in the study and a pilot study was developed under the APCEN network at the University of the North West, Potchefstroom, South Africa. The results of the pilot in Africa were promising with the characteristic chlorotic (white) spots caused by ozone appearing on the leaves of the sensitive clone. The ozone sensitive clover plants showed approximately 20% biomass loss in comparison to the ozone resistant plants. This would imply that the critical levels for natural vegetation and many crops might well be exceeded in this region, if the clover plants respond in the same way to the combined climatic conditions and ozone exposure in South Africa as they do in Europe. Five countries in South Asia (Bangladesh, Pakistan, India, Sri Lanka and Nepal) are also participating in the biomonitoring experiments but the results are not yet available. The choice of participating countries and institutions has taken a lot of time. Initially the pilot study was planned to take place in India, but the import permit for the clover clone plants to India has not yet been granted and so it was decided to carry out the pilot study in Pakistan instead. India will still participate in the study if and when the permit becomes available.

The chemical protectant study was piloted by APCEN in 2006 in Varanasi (India). This study used mung bean (*Vigna radiata* L.) as a bio-indicator since this species is known to be O_3-sensitive and of economic importance in South Asia. The results show that the ozone concentrations in Varanasi were high enough to substantially reduce the number and weight of seeds and pods (by about 50%), the leaf area and the total plant length (also by about 50%) of mung bean. The chemical protectant study is

now being applied in Pakistan and in India as part of the Malé implementation plan. It is planned that a pilot chemical protectant study will also be conducted at the University of the North West, Potchefstroom, South Africa.

The capacity to understand the air pollution impacts of corrosion, as well as the capacity to undertake assessments, has been significantly increased through the RAPIDC activities in both Asia and Africa. The Corrosion Network (CORNET) is a global network funded under RAPIDC that is developing the experimental protocols for use in Asia and Africa, and is combining the results of the corrosion exposures being carried out under CORNET, the Malé Declaration and APINA. Corrosion racks have been positioned in five countries in southern Africa as part of the APINA initiative and in 12 sites in Asia, of which four are part of the Malé Declaration implementation. The training in the setting up of the racks and in the use of the results has taken place and the results of the corrosion experiments, with measured pollutant concentrations, will be available at the end of the Phase III. The dose-response relationships will by this time be more robust and will be able to answer the question as to whether the corrosion in the tropics and sub-tropics occurs faster for a given pollutant concentration than in European climates.

The study of impacts of air pollution on ecosystems in the Malé region is a small project within RAPIDC Phase III and the main focus is assessing acidification risks. Acidification is clearly a regional and potential transboundary issue and therefore, important in the context of regional policy cooperation on air pollution. Recent work by SEI in collaboration with MISU and CAD (see above), improving the risk assessment methods, shows that there are limited areas in South Asia at risk from acidification (e.g. Western Ghats, parts of Sri Lanka and the Himalayan region) and that it may take some considerable time for any changes to be observed. This is consistent with a general lack of observed acidification in the region. There will be a training workshop in late 2007/ early 2008 to enable countries to undertake their own risk assessments.

The current extent and impact of air pollution on natural ecosystems, especially biodiversity hotspots in Southern Africa, is poorly understood and the future development of these problems, including the required policy responses, is unclear. There is also little scientific capacity to address the challenges facing natural ecosystems that are caused by air pollution in southern Africa, as most scientific attention is focussed on issues of crop production and food security. APINA is producing a scoping report on this issue incorporating a proposal for Phase IV activities.

The knowledge of the emissions, transfer, pollutant levels and impacts should all feed into the policy making process to emphasise the need for action but, in addition to that, there is a need for information about the potential solutions to the air pollution problems, their ease of implementation and efficacy. Therefore in both APINA and in the Malé Declaration there are activities to see how the information can be best synthesised and transferred. Partly, a synthesis of policy approaches from the international arena has been developed and training in these options has taken place. In addition to that, the experience in South Asia is also being collated and a further activity will investigate the factors that affect how well policy interventions work in the social and political contexts of the different countries in that region. It is intended that these syntheses and training will increase the capacity of the NIAs and NFPs concerning the different approaches that it is possible to use to reduce and limit the air pollutant emissions from different sectors. Within the APINA work plan, scoping studies on legislation options, control and mitigation options and socio-economic issues are being developed. This process was initiated at a recent training workshop.

At the urban scale, the Air Pollution in Megacities of Asia (APMA) project has produced, with CAI-Asia, a compendium of Air Quality Management (AQM) for 20 Asian cities and analysed their

capabilities and required enhancements. This shows great variation in capacity across Asia and illustrates the very high pollution levels from monitoring data compiled for the cities. The implementation of the AQM strategic framework (SF) developed by APMA will be undertaken in Phase III for Kathmandu in support of the Malé rapid urban assessment and in Karachi to improve their capacity. This will involve direct consultation with the various stakeholders involved in AQM in these South Asian cities and represents a revision of APMA activities in this phase so that its activities become more integrated with the rest of RAPIDC. Contingency funds allowing, a similar AQM SF will be developed in conjunction with the APINA RUA in consultation with the city council and related stakeholders in Maputo, Mozambique.

The different pieces of the knowledge jigsaw required by policy makers in the Malé region are being put together in the Malé Integrated Information and Assessment System (IIAS). In this system the emissions are linked to the results of the atmospheric transfer model to give depositions and concentrations. These can be compared within the system with the results of the monitoring. The regional impacts of the concentrations and deposition are estimated. Finally the different policy instruments are linked to the emission estimates. In addition, all of the reports and methods are easily accessible from the system which therefore combines all information in one place. Some of the work is completed and some is yet to be done to get all building blocks in place. This has been developed to meet the requirements specified by the NIA representatives. It has been used in some of the training sessions to show the result of combining the information from the different parts of the Malé Declaration implementation.

It is important that the knowledge and messages developed in RAPIDC are efficiently transferred to the relevant stakeholders and particularly, to the relevant policy makers. Through the design of APINA and the Malé Declaration, the policy makers are already involved in the process, agree the work plans and discuss the results. Therefore, the process itself encourages transfer of information between the scientists from the region and elsewhere to policy makers.

The promotion of the RAPIDC programme is accomplished via the website and downloadable fact sheets. These are in the process of being updated at the moment. Many of the communication activities are devolved to the regional initiatives – to APINA and the Malé Declaration targeting a broader audience in their regions. This is partly accomplished through the development of newsletters and then through stakeholder involvement in workshops and national initiatives. For example, in the Malé Declaration there is an annual regional stakeholder meeting and there are a number of national stakeholder meetings planned. Dissemination is also conducted through youth groups such as the South Asia Youth Environment network (SAYEN) and major air pollution related events such as BAQ and Saltsjöbaden III.

APINA held its 2006 Annual Meeting in parallel with the IGBP International Global Atmospheric Chemistry (IGAC) programme general meeting in Cape Town. APINA was invited to convene a special session at this international meeting of global atmospheric scientists which show-cased the APINA approach and several of the key projects. There was general excitement from the audience that such coordinated activity was being undertaken in southern Africa by African institutions and with African ownership.

In response to the desire to shift responsibility for RAPIDC and its component parts to partners in Asia and Africa, there have been changes made to the management of RAPIDC during Phase III. The most significant move has been to create a Programme Management Committee (PMC) who manage the programme, even though the responsibility for the programme to Sida remains with SEI for this phase. One deliverable for Sida was a document outlining how the ownership of RAPIDC has

developed over time and what the process for the transfer of ownership in the next phase should be. This was undertaken and submitted in June 2006 and there has been discussion with Sida, within the PMC and with country representatives regarding this issue. The process of transfer of ownership is one where the further development of new proposals, and the implementation of the work plans that result, are fully under the control of the owners. The process should ensure that the administrative duties formerly undertaken by SEI in terms of its contractual obligations to Sida (e.g. responsibility to Sida for the activities, reporting and financial administration, information and outreach) are effectively transferred to the Secretariats of the Malé Declaration and APINA and the coordinators of the different air pollution networks.

The total expenditure for RAPIDC phase III activities up to 30th April 2007 was 20.8 MSEK, and advance payments are not included. In 2006, the disbursement prognosis for the pull-down rate of RAPIDC, as requested by Sida, was MSEK 14.5 M SEK. By December 2006 we had invoiced Sida 12.9 M SEK, and another 1.8 M SEK of 2006 expenditure will be included in next invoice by June 2007. Allowing for late reporting and invoicing from sub-contractors this means that the target disembursement for 2006 has been met. The financial pull-downs for both Africa and Asia are on track according to this prognosis. Both UNEP and IES have mentioned that according to project budgets there are requirements for more funds to hold a number of network and project meetings, which may be covered by contingency but need to be discussed at the PMC meeting with Sida and PAG.

In conclusion, RAPIDC is bringing the regional approach to air pollution management up to ministerial levels and the issue of possible future protocols has been mentioned in both of our focus regions. All of the capacity building initiatives outlined in the proposal in support of APINA and the Malé Declaration have been initiated. In most cases, we are building capacity to assess air pollution which either did not exist in the countries at all or were not directly linked with national governments. Some of the projects have been slow in gaining momentum and for these plans have been made to ensure the expected level of progress by the end of Phase III. The scientific networks are providing high-quality scientific advice to the Malé Declaration and APINA and are mobilising a coordinated effort to address key air pollution issues across Asia and Africa. The ownership of RAPIDC and its activities by stakeholders in Africa and Asia is being strengthened in Phase III and the mechanisms for the transfer of the coordination of the RAPIDC programme have been outlined but some aspects require further discussion with Sida and PAG.

RAPIDC Annual Report 2007

1. Introduction

This is the second Annual Report of the Regional Air Pollution in Developing Countries (RAPIDC) Programme Phase III. The RAPIDC Programme is funded by the Swedish International Development Co-operation Agency (Sida) and co-ordinated by the Stockholm Environment Institute (SEI) on Sida's behalf. The contract for RAPIDC Phase III, signed between Sida and SEI in April 2005, is for a three-year phase covering 2005 – 2008 and builds upon activities in previous Programme periods developed over a 10-year timeframe.

RAPIDC is currently divided into three main focus areas: one main part focussing on the implementation of the Malé Declaration in South Asia, one part on the development of the Air Pollution Information Network for Africa, APINA, activities in southern Africa, and a third part on the development of four different air pollution networks active in both Asia, Africa and internationally.

This report builds on content of the second Half-year Report, which covered activities during May to October 2006, and was submitted to Sida in November 2006. This annual report has been written by the RAPIDC Programme Management Committee (PMC) using the following steps:

1. UNEP RRC.AP/SACEP have compiled a Malé Declaration Implementation report incorporating comments from the technical advisors (Appendix 3 of this report).
2. UNZA/IES have compiled an APINA progress report incorporating comments from the technical advisors (Appendix 4 of this report).
3. CAD, APCEN, APMA and CORNET progress reports have been written by the relevant network co-ordinator (Appendix 5 of this report).
4. SEI has compiled the above Appendices into one report with additional analysis, consideration of the ownership issues and addition of financial and administrative information. A draft structure was distributed and discussed by the PMC during a telecom conducted by SEI on the 24th April 2006 and then SEI has compiled the assessment section and executive summary based on the information included in the individual reports and submitted it to Sida and PAG in advance of the TAC and PAG meetings scheduled for 15/16 May 2006.

Appendix 1 explains the commonly used abbreviations in RAPIDC (and gives website addresses where appropriate) and Appendix 2 contains overview tables of the status of all the projects in RAPIDC.

PAG and Sida Demands on the Annual Report

This report has been written in response to the comments contained in Programme Advisory Group's (PAG) review of the RAPIDC second Half-Year Report and comments made during the Annual meeting in June 2006. The main demands were for the assessment of progress in the context of the status of air pollution issues in our focus regions. Specifically, PAG expressed major concern over the lack of result compilations and data analysis necessary to underpin policy interventions. While PAG

developed over time and what the process for the transfer of ownership in the next phase should be. This was undertaken and submitted in June 2006 and there has been discussion with Sida, within the PMC and with country representatives regarding this issue. The process of transfer of ownership is one where the further development of new proposals, and the implementation of the work plans that result, are fully under the control of the owners. The process should ensure that the administrative duties formerly undertaken by SEI in terms of its contractual obligations to Sida (e.g. responsibility to Sida for the activities, reporting and financial administration, information and outreach) are effectively transferred to the Secretariats of the Malé Declaration and APINA and the coordinators of the different air pollution networks.

The total expenditure for RAPIDC phase III activities up to 30th April 2007 was 20.8 MSEK, and advance payments are not included. In 2006, the disbursement prognosis for the pull-down rate of RAPIDC, as requested by Sida, was MSEK 14.5 M SEK. By December 2006 we had invoiced Sida 12.9 M SEK, and another 1.8 M SEK of 2006 expenditure will be included in next invoice by June 2007. Allowing for late reporting and invoicing from sub-contractors this means that the target disembursement for 2006 has been met. The financial pull-downs for both Africa and Asia are on track according to this prognosis. Both UNEP and IES have mentioned that according to project budgets there are requirements for more funds to hold a number of network and project meetings, which may be covered by contingency but need to be discussed at the PMC meeting with Sida and PAG.

In conclusion, RAPIDC is bringing the regional approach to air pollution management up to ministerial levels and the issue of possible future protocols has been mentioned in both of our focus regions. All of the capacity building initiatives outlined in the proposal in support of APINA and the Malé Declaration have been initiated. In most cases, we are building capacity to assess air pollution which either did not exist in the countries at all or were not directly linked with national governments. Some of the projects have been slow in gaining momentum and for these plans have been made to ensure the expected level of progress by the end of Phase III. The scientific networks are providing high-quality scientific advice to the Malé Declaration and APINA and are mobilising a coordinated effort to address key air pollution issues across Asia and Africa. The ownership of RAPIDC and its activities by stakeholders in Africa and Asia is being strengthened in Phase III and the mechanisms for the transfer of the coordination of the RAPIDC programme have been outlined but some aspects require further discussion with Sida and PAG.

recognised the merits of general reporting of managerial issues and methodological matters related to monitoring and modelling, it stressed that future RAPIDC reports should be complemented by a section of more result-oriented character, containing examples and salient points of substantive progress in implemented projects and an analysis of that progress. PAG suggested that the RAPIDC management team should be invited to make an assessment of the performance and potential policy relevance of individual projects based on results and problems encountered. In summary PAG suggested reports should address the following:

- a synthesis and analysis of results in relation to the RAPIDC Programme LFA objectives provided in the next Annual Report, i.e. May 2007;
- a move towards increasingly addressing dissemination of results to important stakeholders and the development of responses to air pollution problems;
- future ownership of the RAPIDC process will be addressed in the next Annual Report;
- expect the next Annual Report to be more geared towards external readers and stakeholders and, of course, to Sida;
- suggest that a reader-friendly press release be prepared in conjunction with the report. Once approved by PMC at the review meeting in May 2007, the press release could be distributed, primarily to the Swedish media;
- concern with Malé is the need to further increase efforts to analyse data, to explore further inter-linkages and to draw policy-relevant conclusions, even if preliminary;
- more focus on science-based policy-relevant information and to increase efforts to facilitate political commitments. The country-specific circumstances and priorities must be identified and considered for applying tailor-made approaches to the abatement of air pollution;
- For APINA it is also important that it continues to strive for the facilitation of policy development.

This document includes the analysis which is reflected in the Executive Summary. A draft of a Glossy Document to be published later in the programme will be proposed at the PMC meeting that puts the progress of ten years of RAPIDC into the overall context of air pollution in these developing country regions, of other activities on-going and the work that remains. The press release will be tabled at the PMC meeting.

The following section provides the main elements of the LFA for RAPIDC and analysis in later sections is made with reference to this LFA.

Key objectives and expected results from the RAPIDC LFA

The overall objective of RAPIDC is to contribute to solving air pollution problems in the key regions of interest (South Asia plus Iran and southern Africa). RAPIDC aims to achieve this overall objective through its Programme Purpose which is '*to facilitate the development of agreements and/or protocols to implement measures which prevent and control air pollution through promoting international cooperation and developing scientific information for the policy process*'. This objective drives the development of RAPIDC and the main activities undertaken which are essentially

to engage with the policy process in the regions of focus and ensure that the best scientific information is effectively and efficiently transferred to policy making.

As can be seen in Figure 1.1, the Programme Purpose of RAPIDC is being achieved by facilitating international cooperation in South Asia through support for the Malé Declaration and in southern Africa through support for APINA. Finally, there are a number of scientific networks developed to synthesise expertise across the regions such that they can efficiently fill gaps in knowledge through their promotion of specific activities. These can help to define common assessment methods for use in the RAPIDC core regions to allow assessments of their air pollution problems. There is a purpose to each of these elements and when these are achieved the overall RAPIDC Programme Purpose is achieved.

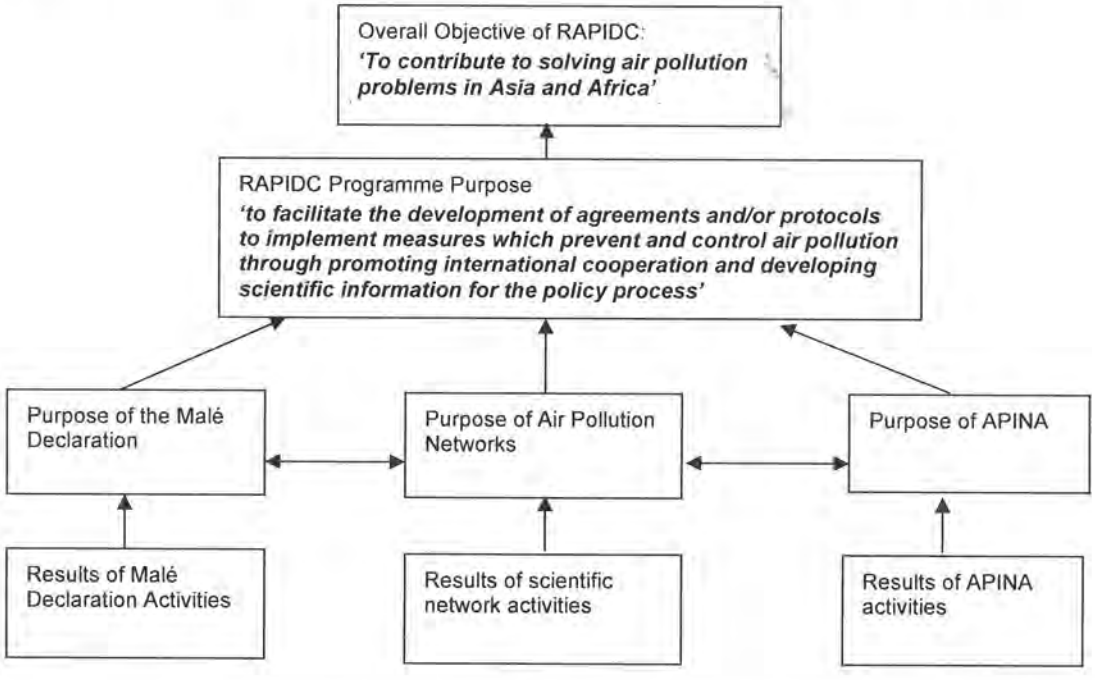


Figure 1.1 Revised Objective tree of the Logical Framework Analysis for the RAPIDC programme

The purpose of the Malé Declaration is shown in Figure 1.2. When the activities in this proposal have been carried out it is intended that these will result in a significant advance towards the purpose of the Malé Declaration. The results of carrying out the Malé Declaration activities are shown in Figure 1.2. The purpose of APINA and results of APINA activities are shown in Figure 1.3.

The purpose of the air pollution networks is: 'To link together research efforts in Asia, Africa and internationally and undertake activities to promote understanding where major gaps in knowledge about air pollution exist, and also aid the development of Malé Declaration and APINA activities as appropriate'. The networks are the Composition of Asian Deposition (CAD), the Air Pollution and Crop Effects Network (APCEN), the Corrosion Network (CORNET) and the Air Pollution in Megacities of Asia (APMA) project. When the activities in this proposal have been carried out it is intended that these will result in a significant advance towards the purpose of the air pollution networks. The purpose and results of the different networks are shown in Figure 1.4.

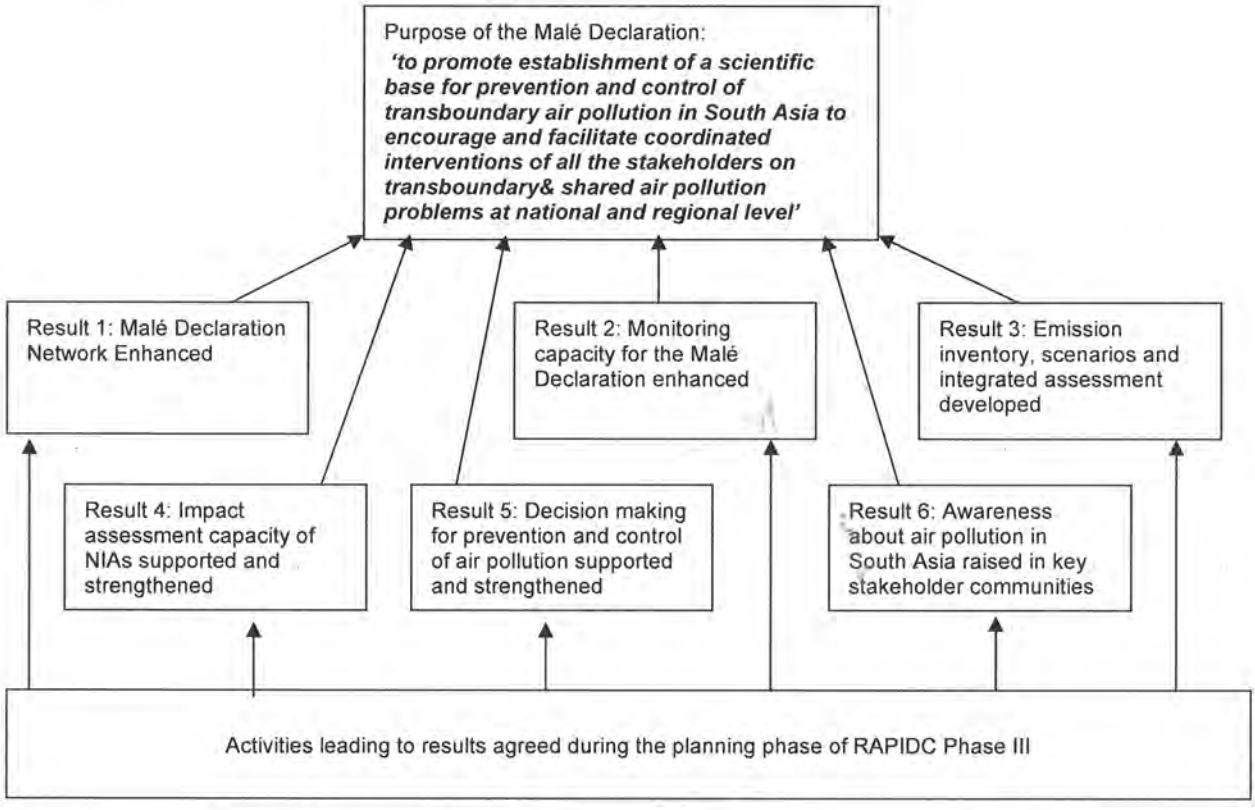


Figure 1.2 Objective tree for the South Asian activities of RAPIDC related to the Malé Declaration

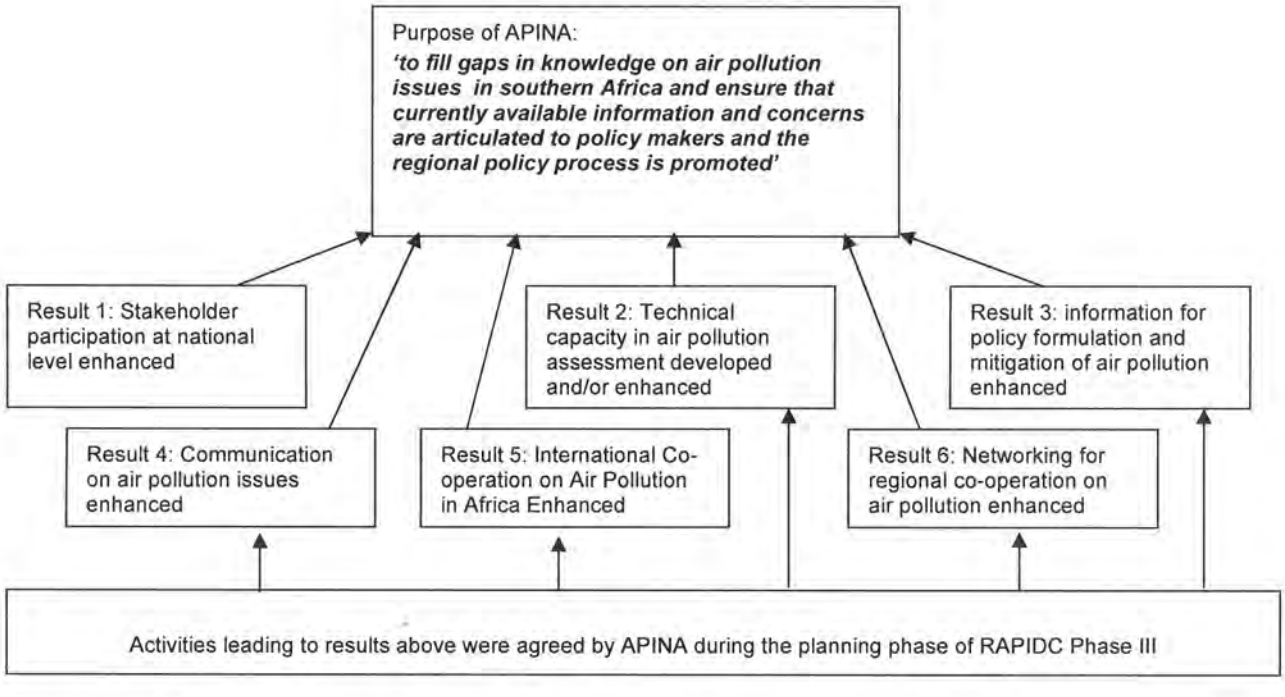


Figure 1.3 Objective tree for the APINA activities in RAPIDC Phase III

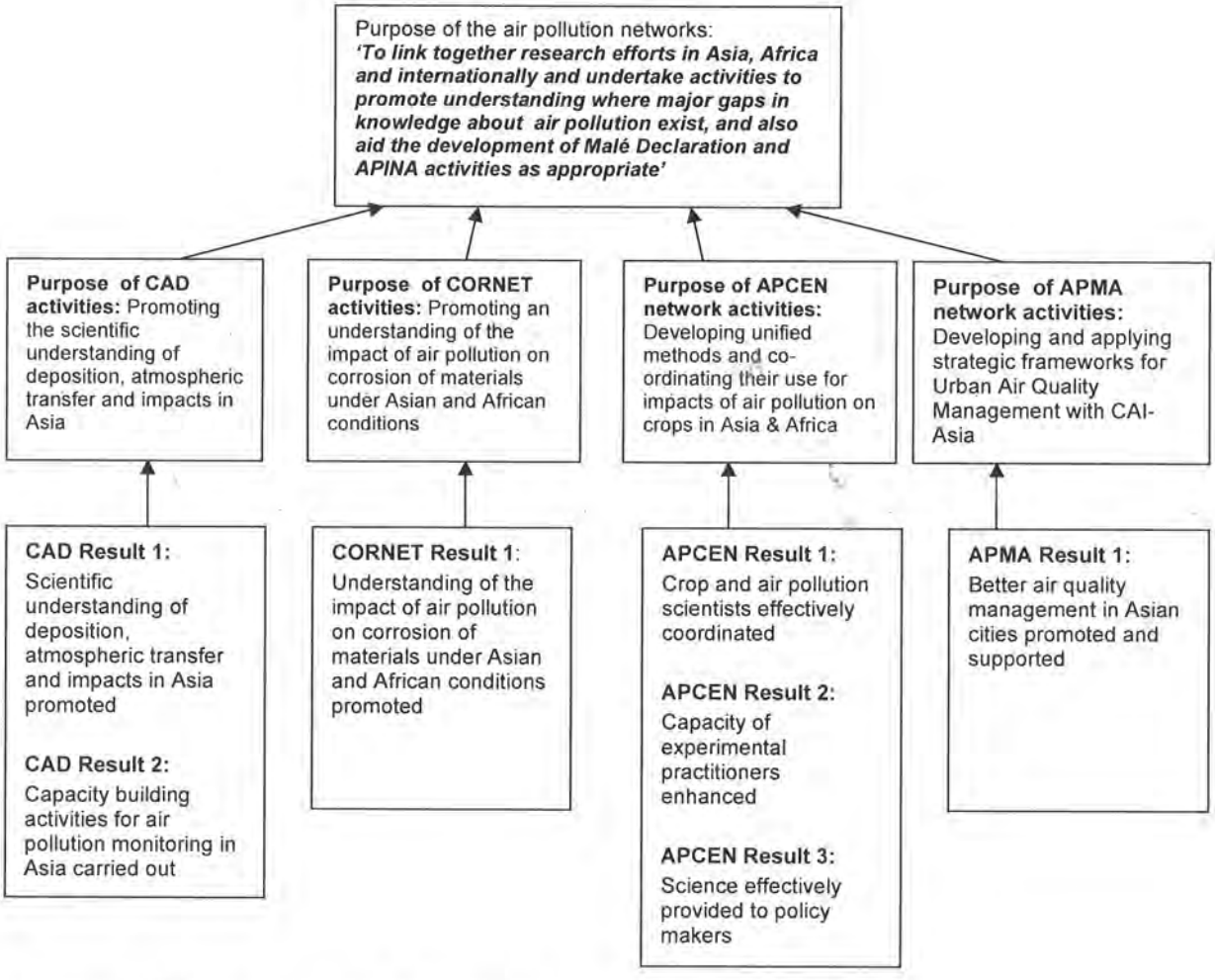


Figure 1.4 Objective tree for the Scientific Networks activities of RAPIDC

2. Overall progress in 2nd Year of RAPIDC Phase III

The function of this section is to provide an overview of how RAPIDC is doing in relation to its stated objectives in the context of air pollution problems in Asia and Africa. This is done in relation to the 'policy cycle' concept that underpins the development of knowledge for policy making on air pollution within RAPIDC, and the policy context within which RAPIDC components are operating. It is also discussed in relation to the Purpose of RAPIDC: *'to facilitate the development of agreements and/or protocols to implement measures which prevent and control air pollution through promoting international cooperation and developing scientific information for the policy process'.*

2.1 A focus on regional policy development in Asia and Africa

From European experience, the development of regional agreements on air pollution can act as a powerful stimulus for progress in developing air pollution prevention and control strategies within countries and across whole regions. The Convention on LRTAP of the UN/ECE has been one of the main drivers of policy development to limit pollutant emissions. Such agreements can act towards

resolving transboundary issues and the process of formulating agreements can be important for highlighting problems and preventing pollution within the different nations.

In contrast nearly all policy development in Asia and Africa is at national and local, urban scales. This does not allow transboundary issues to be tackled and also hinders development of coherent policies across regions that can solve some of the local or national-scale problems for example, to set regional fuel quality standards that require international cooperation. However, to move from a situation where countries are setting up air pollution policies independently to one where the policy development is coordinated requires a 'road map' and framework within which countries can develop such arrangements. Thus, the following are required:

i. A framework for regional cooperation;

ii. Activities that build the capacity and supply the methods to develop the scientific knowledge about air pollution from local to regional scales, and its potential transboundary impacts;

iii. Results showing the extent of regional air pollution, transboundary transport and associated impacts;

iv. An intergovernmental process by which agreements and protocols can be developed on the basis of proven need regarding shared and/or transboundary air pollution problems;

v. Regional policy development with national and regional commitments.

The development of regional inter-governmental policy therefore is influenced by the findings and conclusions concerning regional air pollution issues, including transboundary transport of air pollution that requires the regional cooperation. The role of RAPIDC within this policy development context is to promote the development of regional cooperation and undertake activities and develop/ refine methods to build capacity to understand the different air pollution problems and come up with the results that can inform the development of regional policies and agreements, and demonstrate their necessity.

RAPIDC is not working in a vacuum. There are a number of national and international initiatives operating in the focus regions and the aim is to complement these and use their results in further developing the portfolio of knowledge that can be transmitted to policy makers.

2.2 Regional Frameworks for Cooperation and Development of Agreements

In both South Asia and in southern Africa, frameworks for regional cooperation are in place, thanks in large part to the activities undertaken under the RAPIDC programme. The 'Malé Declaration on the Control and Prevention of Air Pollution in South Asia and its likely Transboundary Effects' has been operating since 1998. In southern Africa, the Air Pollution Information Network for Africa (APINA), formed in 1996, is providing the framework for the international cooperation and linkages between the governments of the seven countries involved, and also helping to link policy makers throughout sub-Saharan Africa. The Malé and APINA frameworks allow countries to meet and discuss their air pollution issues. The scientific networks provide frameworks for international cooperation between key scientists in Asia and Africa (in the case of CAD, APCEN and CORNET) and between Asian urban authorities in the case of APMA, who work in collaboration with the CAI-Asia urban network. The focus of these regional frameworks is a mixture of shared problems – for example, of urban air

pollution and its impacts on human health - and transboundary problems through long-range transport of air pollution. The countries in the region share many common problems and a lack of capacity to approach them. Regional cooperation within RAPIDC is allowing countries to develop common approaches to dealing with these issues and promote more rapid development of national and urban policies.

2.2.1 Progress towards regional agreement in South Asia and Iran through the Malé Declaration

The Malé Declaration is the only inter-governmental agreement of its kind covering the eight countries involved and is therefore valuable and it is important for the region that it succeeds. The objective of the Malé Declaration is '*to promote the establishment of a scientific base for prevention and control of transboundary air pollution in South Asia to encourage and facilitate coordinated interventions of all the stakeholders on transboundary and shared air pollution problems at national and regional levels*' and therefore there is a focus on building the scientific basis for agreements and ensuring that there is active involvement of the policy makers in the ministries of environment of each country (the national focal point (NFP)).

The Malé Declaration provides a regional forum to discuss the development of protocols and other such policy interventions but does not encompass this level of ambition within the Declaration itself. This has made it easier for the countries to agree to cooperate, and once the scientific information starts to flow more regularly it is anticipated that the policy discussions in the region will follow. The exact path for such inter-country policy discussions is not clear as yet and it is necessary for the trust in the collaboration on this issue to be strengthened to pave the way for such discussions, which are not without difficulty in this region. However, the fact that the Ministers can be brought into the discussions about the Declaration progress and plans at the SACEP Governing Council means that it is discussed at this high policy level. It is also helpful that in his role as UNEP's Asia-Pacific regional Director, Surendra Shrestha is able to promote the regional discussion and policy process development at the very highest levels of government in the Malé region.

There is an annual meeting of representatives of the governments of the eight Malé countries. Although the Malé Declaration was not set up to develop protocols *per se*, but to foster cooperation on air pollution issues, this inter-governmental meeting does present opportunities for the countries to discuss further development towards regional agreements or protocols. In the review document tabled at the 2006 meeting, it suggested that discussion on the need for a protocol may be deferred for a year once data flow from the different technical activities starts to flow in and be verified. In other words, once the underlying information about the degree of transboundary transfer of air pollution and the significance of shared problems and the opportunities afforded by regional action, the need for protocol development should become more obvious.

In terms of building the scientific capacity, the Declaration has initiated activity in all major areas of air pollution research. This is embedded within the national policy structures and forms part of the work plan for the ministries of environment involved. The focus has been to ensure ownership of the scientific activities by the ministries by asking them to nominate the institutions who will undertake the assessments or measurements. This has ensured the strong link between the policy makers and the science, but has also slowed the implementation due to the inevitable increased bureaucracy involved in such an approach. The difficulty in creating the momentum for such institutional development, in what is a unique and novel regional approach in South Asia, should not be underestimated.

Therefore the focus of the Malé Declaration is not only to provide scientific results but to ingrain the process of producing the data and knowledge in the Government system such that the likelihood of its sustainability outside the framework of RAPDIC is increased. Therefore, in terms of the institutional set-up the Malé Declaration has progressed satisfactorily. The capacity of nominated institutions to undertake the assessments and measurements has been built up and in many cases represents a new capacity for air pollution issues in many countries.

The speed with which scientific data is being produced is not as fast as it would have been through contacting the University sector and by-passing government. In some cases the Ministries use the University sector in the Malé Declaration and such interactions are encouraged. However, this involves funding an agency outside of the Ministries and such unallocated funds are not found in abundance by Ministries of Environment in the region. The planned structural development for the Malé Declaration shown in Figure 2.1 below, which was discussed and adopted by the Intern-governmental meeting in Bhutan, should further enhance the regional cooperation and speed by which the data are produced, used and disseminated. This is similar to the lead country approach adopted in the UN/ECE LRTAP development. It is intended that each specialist centre will coordinate the activities in the specific field of all countries involved. This will further anchor the control of the Malé Declaration activities in the region.

Whereas the RAPIDC initiatives in support of the Malé Declaration cannot, of themselves, lead to the development of protocols, the existence of an agreement between the countries at all is a major step forward, as is the development of regionally coordinated technical activities. In addition, the structures to enhance the network that are now being proposed will strengthen the stability of the regional cooperation framework and embed long-term commitment of the countries to the regional process regarding air pollution.

Enhancing the Malé Declaration network

The aim of this project under Phase III is to enhance the Malé Declaration network through: 1) strengthening regional cooperation; 2) strengthening stakeholder participation under the Malé Declaration; and 3) strengthening national structures to support the Malé Declaration.

The regional network development has been strengthened in a number of ways. There is the annual Intergovernmental Meeting of the NIAs and NFPs. There is also regular formal and informal contact between the Secretariat and the NFPs and NIAs. This takes the form of visits regular telephone calls, regular communication through email, involvement of the NIA and NFP personnel in Malé training activities and also involvement of the same individuals in other training and meetings, not related to the Malé Declaration, but which are coordinated by the UNEP office. In addition, the countries and their representatives are kept updated through the quarterly newsletters and the development of a Malé Declaration brochure which can be used to spread the word about the Declaration within the countries. Beyond this intergovernmental meeting, the different training workshops held under the Malé Declaration also presented opportunities for both technical people and policy makers for the ministries to meet and hence strengthen the regional and intergovernmental cooperation.

The Intergovernmental Meeting (IG) on the Malé Declaration is the decision making body for the Malé Declaration and held its Eighth Session in Thimpu, Bhutan on 13 September 2006. At this meeting the countries, through their representatives from the National Focal Points (usually the Ministries of Environment or equivalent), or through nominated National Implementing Agencies (either ministries or other institutions nominated by governments) have control of the development of the Malé Declaration. This is also an opportunity for the technical aspects to be presented and

discussed with the national representatives, fostering science-policy transfer. Beyond the representatives of the countries, regional organisations, technical advisors and facilitator, a representative from Afghanistan also attended as an observer. At this meeting the review of the Malé Declaration by the facilitator, Mr R Rajamani who prepared it based on the consultation with the owners of Malé Declaration (governments and stakeholders), which discussed progress towards a protocol and other such matters was accepted as was the work plan for 2006/7. Various recommendations were made at the IG8 for inclusion in the Phase IV proposal. This included the data format for reporting meteorological data, the implementation of an extended institutional structure (Figure 2.1), the institution of long-term training programmes for smaller countries such as the Maldives, support for a health impact assessment study in Pakistan, and support for additional monitoring sites in Bangladesh, Iran and Nepal.

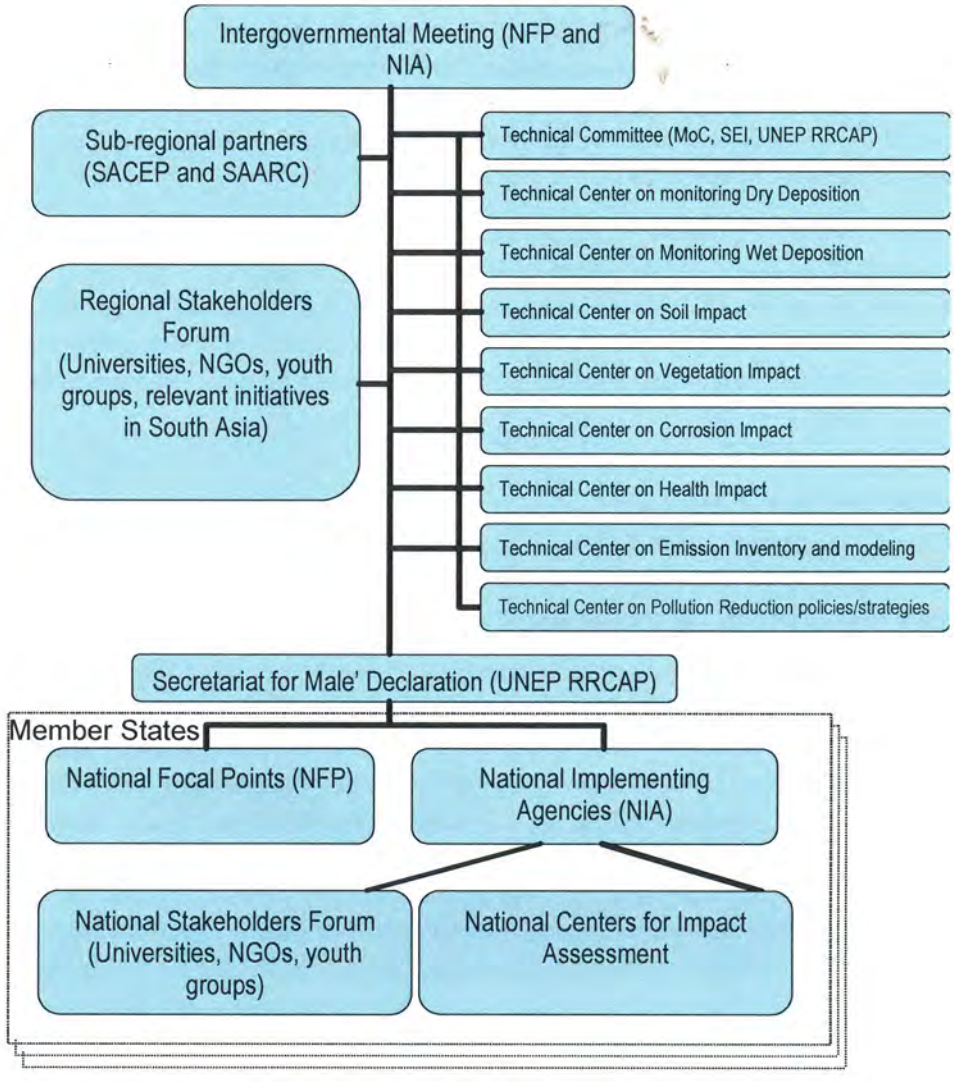


Figure 2.1 The proposed new institutional structure of the Malé Declaration

The financing of the Malé Declaration is very important. The only external financing comes from Sida through RAPIDC, but each country also puts in its own resources. These include manpower to

monitor the monitoring site, administrative work, purchase of land and using national laboratories and meteorological stations for the data needed for Transboundary air pollution research.

The status of Malé Declaration implementation was presented to the Ministers of the Environment at the SACEP Governing Council and they noted the conclusions of the intergovernmental meeting in Bhutan and were generally happy with progress.

An Exchange Programme between the national level Project Managers (NIAs) and the Secretariat at UNEP RRC.AP, to initiate the planning for Phase IV and to collate the learning from Phase III activities will be held during 22 to 31 May at UNEP RRC.AP office, Thailand. At this meeting the countries will develop reports of their progress and also develop the proposal for activities required in their countries in the next phase.

The focus of the development of the Declaration over recent years has been to embed the Malé process through linkages between the policy and scientific institutions which will provide the engine for further development of the Declaration. At the same time there is a realisation that parties and stakeholders outside the Declaration need to be involved and outreach to them is very important. Malé Declaration is one of the few intergovernmental networks to have a formal network for stakeholder consultation. The consultation is being facilitated through annual meetings. There has been a regional stakeholders meeting of key regional stakeholders from the science and NGO community for a number of years but there is also a realisation that further stakeholders need to be brought in and a number of activities are increasing the breadth of stakeholder engagement.

The purpose for the coordination meetings is to ensure that the governments are aware of the major air pollution-related activities occurring in the Malé region and important activities outside the region from which they can learn. The regional stakeholders are chosen who represent NGO, Universities stakeholders across the region and they have been invited to hear about the Malé Declaration and related activities and it is intended that they relay these findings to their networks. The Third Regional Stakeholders cum Coordination meeting of Malé Declaration was held in Thimpu, Bhutan during 12 – 13 September 2006. The meeting was attended by the National Focal Points (NFP) and National Implementing Agencies (NIA) of Malé Declaration as well as representatives from various stakeholders groups and ongoing initiatives on air pollution at national, sub-regional, regional, and global levels. The member countries were requested to implement public awareness activities through various media and forums, such as the Malé Declaration brochure in local languages. The participants recommended that the civil societies be represented in the group of stakeholders. As requested by the previous stakeholders' forum, additional stakeholder groups are being added to the forum. For example, the eighth intergovernmental meeting was attended South Asia Youth Environment Network as the first time.

At the national scale the development of multi-institutional involvement in Malé activities is being encouraged and also the involvement of a range of stakeholders within each country to broaden the base of the Malé Declaration implementation in each country. Expert institutions to conduct the assessment studies of Malé Declaration activities at the national level have been identified through stakeholder consultation. There is also increased awareness due to articles published by the NGOs who attended the Stakeholders forum. The 1st meeting of National Advisory Committee (NAC) organized by Bangladesh NIA is held on under the Chairmanship of Mr. Tariq-ul-Islam, Joint Secretary, Ministry of Environment and Forests (MOEF) on 2nd July 2006 at the Conference Room of the MOEF. The meeting decided 1) to post the monitoring results in the website of the department. 2) list of institutes/organizations which could be given the responsibility for air pollution impact

studies. 3) Selected head of Environmental Science Discipline of Khulna University to involve with the operation of AAS and 4) request for Air Matrix Sampler (Low Volume) to monitor PM_{10}, at the monitoring site. A further national stakeholder consultation in Sri Lanka is planned on 12 June 2007 by the Central Environmental Authority, Sri Lanka. This will aim to deliver similar results in Sri Lanka, Nepal and Bhutan during Phase III implementation period.

2.2.2 Progress towards regional agreements in southern Africa through APINA activities

APINA is the only network of its kind in Africa covering seven southern Africa countries. Its purpose is *"to fill gaps in knowledge on air pollution issues in southern Africa and ensure that currently available information and concerns are articulated to policy makers and the regional policy process is promoted."* The current activities of APINA derive from APINA discussions at the Maputo Regional Policy Dialogue (RPD) in 2003 that was attended by several ministers of environment, government representatives, scientists and other relevant stakeholders. The outcome of the policy dialogue was a draft declaration, the *"Maputo declaration on the prevention and Control of Air Pollution in southern Africa and its Likely transboundary Effects."* Through discussion, a strategy was devised to have the Draft Declaration endorsed by SADC ministers and to feed into the activities of the New Partnership for Africa's Development (NEPAD). An Organisational structure which facilitates information flow to Ministers of Environment at both national and regional levels has been set up (Figure 2.2). This structure has been working efficiently in enhancing information flow at both national and regional level.

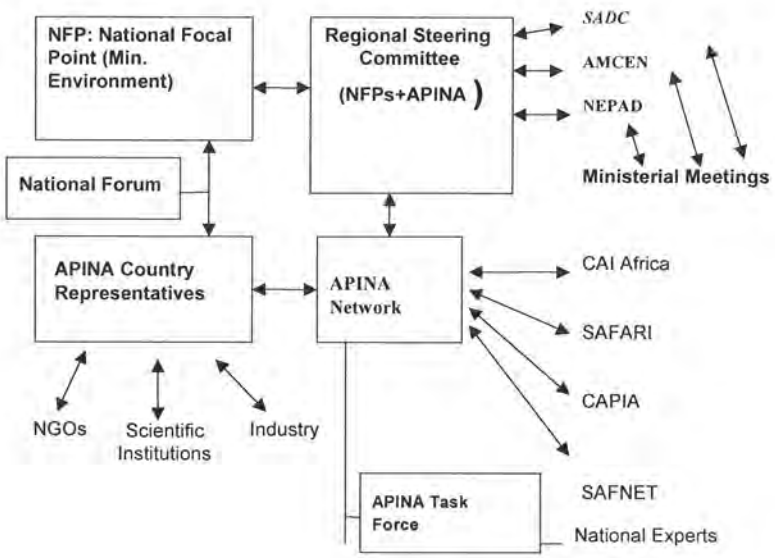


Figure 2.2 APINA organisational structure for transfer of science to policy in southern Africa agreed by APINA members and Ministers of Environment at the 2003 regional Policy Dialogue in Maputo, Mozambique.

Through this structure, National Stakeholders Meetings involving government officials overseeing environmental, health, energy, industry and civil society are being held annually in all the seven APINA participating countries where APINA and relevant stakeholders present progress on activities on air pollution issues in each country. The meetings are convened by the NFPs thus putting air pollution issues on the national political agenda. During APINA Phase III all the seven participating countries have successfully held stakeholders meetings that have raised awareness on air pollution issues with senior government officials opening the meetings and attracting nationwide media publicity.

Resolutions from these national fora have then been taken to the APINA annual meetings that are attended by all NFPs of the APINA participating countries; APINA Country Representatives (ACRs) who coordinate APINA activities in each country and Task Team Leaders (TTLs) for each activity being undertaken in the RAPIDC programme. The meetings also discuss issues of how the scientific findings can be fed into the policy process and the process through which the Maputo Declaration can be adopted. The last APINA annual meeting held in Cape Town in September 2006 adopted steps towards protocol development. The next APINA annual meeting will be held in October/November 2007 to discuss how the scientific information generated during Phase III should be packaged to influence policy decisions and to form the basis of informed policy making in the region.

Since its inception, APINA has held Policy Dialogues within the SADC context to promote the development of protocols on air pollution in the region. The next dialogue will be held in February 2008 in Gaborone, Botswana, the headquarters of SADC. Discussions are underway to involve SADC in the hosting of the policy dialogue to ensure the adoption of the Maputo Declaration.

In the interim, APINA held a meeting in July 2006 that was attended by senior Advisors to Ministers of Environment from 10 of the 14 SADC countries to set up logical steps towards intergovernmental agreement on air pollution. The meeting agreed that the Maputo Declaration was a good basis for progressing towards an inter-governmental agreement on air pollution issues for the SADC region. Meanwhile SADC has revived the process of harmonizing of regulatory frameworks, one of which will be the SADC Protocol on Environment and has invited APINA to be a technical partner on air pollution issues through the Memorandum of Understanding APINA has had with SADC since 2001.

In addition, the influence of APINA on urban air pollution issues has expanded from the SADC region to the 49 countries that comprise sub-Saharan Africa. As part of the RAPIDC programme, APINA has initiated the development of the Regional Conference on Better air Quality in Sub-Saharan African Cities. In order to enhance its impact, APINA has formed partnerships with other players in the region and together with UNEP – Partnership for Clean Fuels and Vehicles, the World Bank- Clean Air Initiative for sub-Saharan Africa Cities, SEI and USEPA held BAQ-SSA 2006, in July 2006 where 49 sub-Saharan countries were represented and Ministers of Environment of 30 countries were present, to discuss the issue of urban air pollution, its link to poverty, capacity building needs and the opportunity to reduce or prevent emissions. The resulting discussions came up with recommendations on policy and strategic issues; institutional arrangements, capacity and implementation; public awareness, information and education as well as cooperation and partnerships between government, civil society, the private sector and international bilateral organisation.

One of the recommendations on policy issues was the need to lower sulphur levels in fuels. As a follow up to BAQ-SSA 2006 meetings are being held at sub-regional levels to facilitate an agreement on specific targets and timeframe. APINA through the RAPIDC programme has made commendable progress in driving several agreements and policy decisions to prevent and control air pollution in the African Region, thus fulfilling the Programme Purpose of RAPIDC.

2.3 Building national and regional capacity on air pollution issues: results thus far

The regional frameworks, facilitated by funding through the RAPIDC programme, are now developing the technical capacity of the countries in the two regions to assess the significance of air pollution and the measures by which air pollution-related damage can be reduced. This is also being undertaken through consultation with the governments. In this way the ownership of the process is clear and the scientific communities of the African and Asian countries are responding to policy maker needs in the different Ministries of Environment.

The different types of information required by the policy making process for air pollution issues are shown in Figure 2.3. Each of these aspects, including their integration is included in the various projects of RAPIDC.

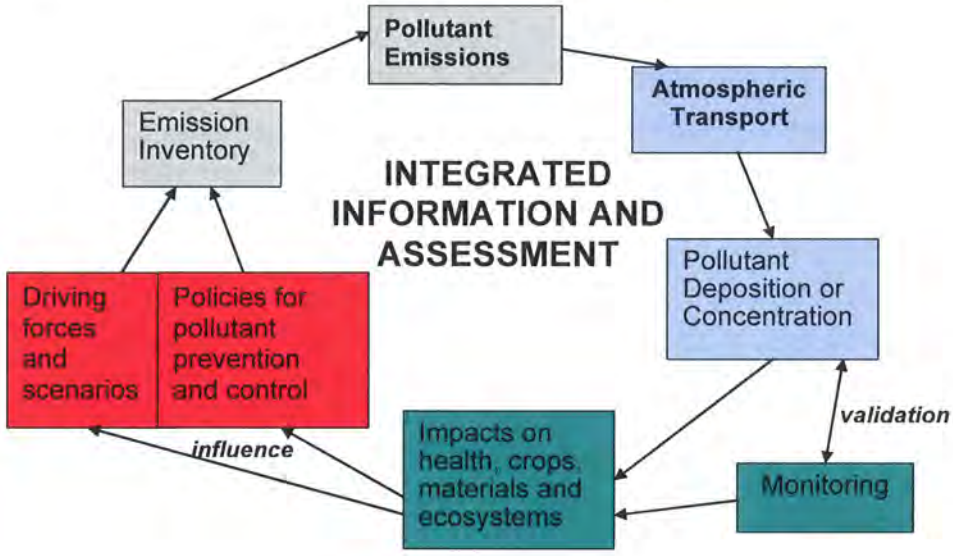


Figure 2.3 Information required for policy making to reduce impacts of air pollution - commonly referred to as 'the policy cycle'

Through developing and modifying existing methods and making them appropriate for use in our target regions, capacity is being built for the assessment of the implications of air pollution at urban, national and regional scales. The highlights of the progress so far are described below in relation to the different boxes of Figure 2.3.

2.3.1 Building emission inventory and scenario capacity

It is difficult to develop comprehensive policies at any scale without a reliable emission inventory. Clearly in some cases there are such obvious problems that decisions should be taken without waiting for further study, but once these 'low hanging fruit' have been 'picked', there is a need for more information about the significance of different emission sources and their contribution to local or regional pollutant deposition or concentration levels. RAPIDC has produced variants of an emission inventory manual and excel-based spreadsheet, one tailored for the Malé Declaration region and the

other for APINA. In each case the network members were informed of the development and their suggestions for focus and regional applicability were used to modify the manual that is now being used for capacity building.

The methodology for emission inventories has now been developed and tested and is being implemented by all Malé countries. In the Malé countries no official emission inventory for air pollutants has been produced by the governments concerned to date, with estimates being made by academics and institutions from inside or outside the region. As part of RAPIDC, the capacity building has been of representatives of either the NFP – i.e. Ministry of Environment Officials, NIAs – the national implementing agency - nominated by the NFP, or some other institution brought in to help develop the first government-led national emission inventory development in this South Asian region. There have been two training workshops and all countries are filling in the excel spreadsheets with their data for emissions from different sectors and point sources in their countries; many have been contacting different ministries to find data. These emission inventories are preliminary and the workbooks from most of the countries have been sent to the Malé Declaration Secretariat and Harry Vallack of SEI who check them and advises them on improvements. India attended the first workshop but did not get permission for the second in time and so the progress there is unclear, but for all other countries the emission inventories are on track.

In APINA the training has been for two people from each of the seven APINA countries – one from a government department and one from academia. This combination has proved very effective in linking universities with government representatives and progress in developing the emission inventories is good. The work is organised through a Task Team for emission inventories, with a Task Team Leader and task team members at relevant institutions in each country. This structure should provide continuity and allow regular updating of the emission inventories, which is an essential requirement for the development of improved and recent emission estimates.

It is intended that at the end of Phase III there will be a draft emission inventory for each country in Malé and APINA, which includes data for all relevant sectors and sources which has had some quality control by SEI through looking at the workbooks and checking for mistakes and by cross checking with other emission inventory results for the countries in question (e.g. the international EDGAR initiative). An example of the preliminary data produced for Pakistan is shown in Figure 2.4 and for Zimbabwe in Figure 2.5. It is interesting to note the difference between the SO_2 emissions from the energy industries in the two countries where Pakistan emissions are much less than Zimbabwe's because of gas rather than coal use. A similar contrast is found between India and Pakistan. Therefore, by the end of Phase III there will be emission inventories undertaken by and/ or for governments in South Asia and southern Africa where there were no inventories and little capacity before.

As well as developing historical emissions in a recent year based upon statistical data, it is also important for policy makers to know the resulting emission from different development pathways, especially in dynamic regions such as South Asia. For this reason there has been the development of scenario approaches and training for the participants in the emissions workshops. By the end of Phase III, beyond the increased knowledge of the NIA and NFP representatives of scenario and backcasting approaches, the methods to include scenarios in the emission inventory calculation will be developed with examples for some sectors. This aspect can then be further developed in further, eventual phases.

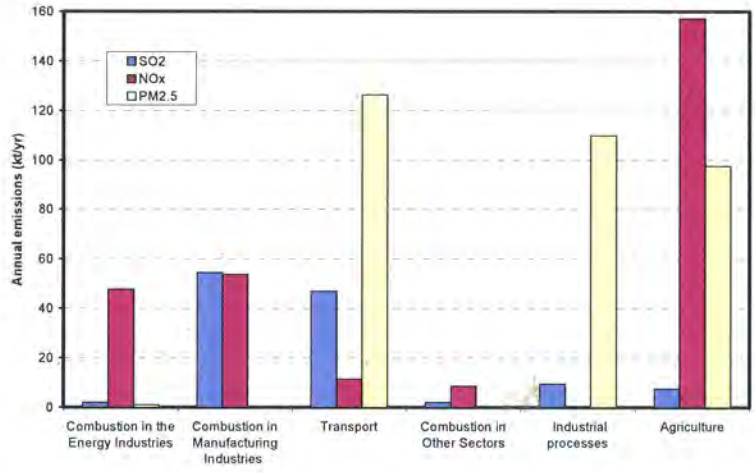


Figure 2.4 Draft and preliminary figures for the emissions of three pollutants from different sectors in Pakistan.

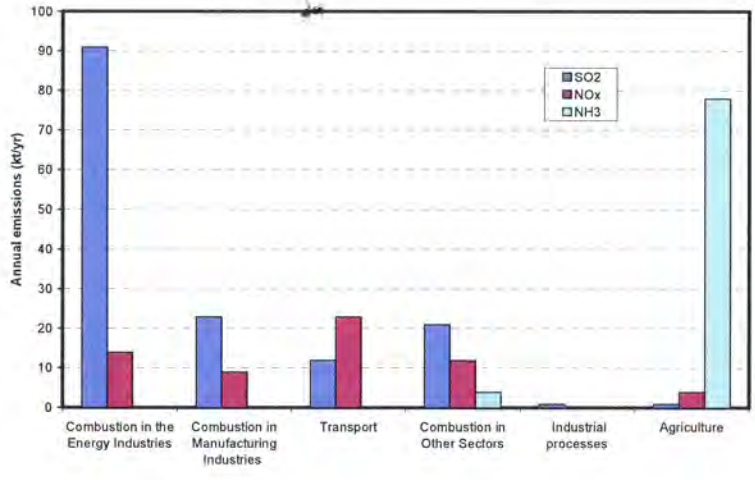


Figure 2.5 Draft and preliminary figures for the emissions of three pollutants from different sectors in Zimbabwe.

At the urban scale the rapid urban emission assessment methods are now being applied in Kathmandu, Nepal, and Maputo, Mozambique, following on from the successful pilot study in Hyderabad in phase II. The training has been taking place and data currently being gathered in both cities. The results will be a distributed emission inventory using a combination of a top-down emission inventory based upon the Malé and APINA regional emission inventory manuals, distributed using satellite imagery and bottom-up data.

2.3.2 Understanding the degree of regional transport of air pollutants

The transport of air pollutants once emitted can de determined through trajectory analysis and modelling. Atmospheric transport modelling is the only way to investigate the long distance transport of air pollution and potential transboundary transport of air pollution, which is an important piece of knowledge for regional policy development as described above.

In south Asia, atmospheric scientists, NFP and NIA representatives of the Malé Declaration have been trained in trajectory analysis methods and introduced to the concepts behind the MATCH atmospheric

transport model of SMHI. Each country was encouraged to undertake trajectory analysis using free website software (NOAA HYSPLIT: www.arl.noaa.gov/ready/hysplit4.html) for their monitoring station to more fully understand the methods and assess where the pollutants are derived from that are being monitored at their stations. It is unclear if any countries have undertaken this analysis.

The MATCH model is developing estimates of deposition and concentrations sulphur, nitrogen, $PM_{2.5}$ and ozone for the Malé region to investigate regional transport and allow deposition and concentration estimates to be made on the basis of recent emission estimates or scenarios. Currently the models use international emission estimates, but in the future they will be able to use the national emission estimates that result from the emission inventory activity, once these are available. Near surface concentrations of sulphur dioxide (Figure 2.6a) and nitrogen dioxide (Figure 2.6b) and the accumulated dose over a threshold of 40ppb (AOT 40) for ozone (Figure 2.7) have been calculated by the MATCH model for South Asia. The MATCH model results for sulphur dioxide and nitrogen dioxide demonstrate that the largest concentrations are found close to the source regions, as could be expected from these relatively short-lived pollutants. Simulations have also shown the degree of transboundary transport of pollution around the region. However, until the inputs to the model, such as the emission inventory, are improved, it is too early to make accurate assessments on the extent of this transboundary transport.

The AOT40 results for ozone show that during the September to October period, which is the main growing season for many crops in South Asia, exceedance of the European critical level for wheat occurs over large parts of India, as well as north eastern Pakistan, much of Bangladesh and a large swathe of the Tibetan plateau (Figure 2.7). Adverse impacts of surface O_3 on agriculture might therefore be expected with the potential for yield losses in the region of up to 30%, assuming applicability of European derived air quality dose-response relationships.

(a) SO_2 (b) NO_2

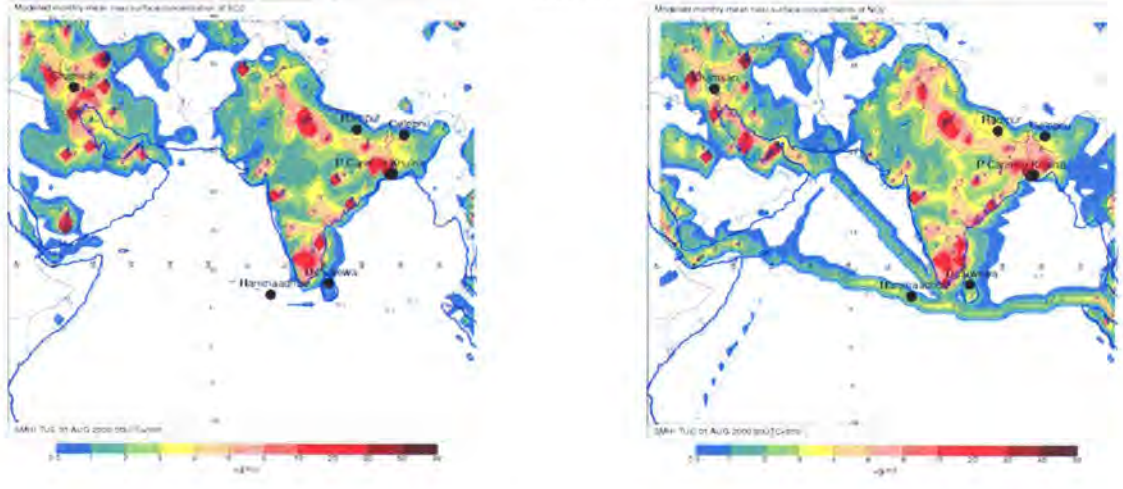


Figure 2.6 The near surface concentrations of SO_2 and NO_2 across South Asia from the MATCH model using EDGAR emission estimates for 1995.

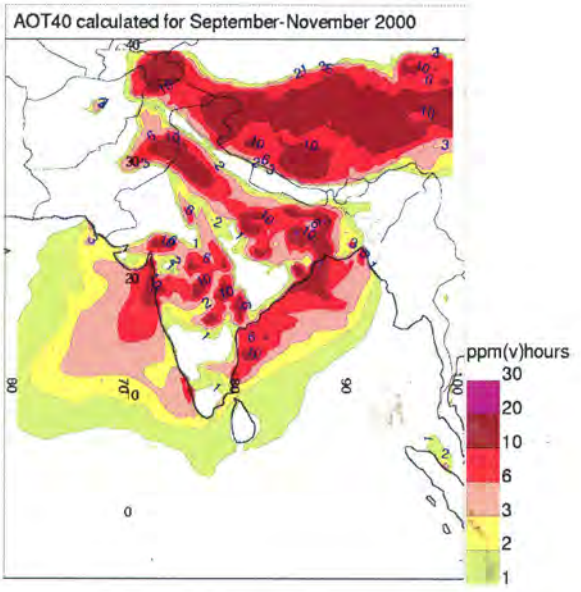


Figure 2.7 Three month (September to November 2000) AOT40 simulations for ozone calculated using the MATCH model (Engardt, pers.comm.).

The MATCH model has now been installed at UNEP RRC/AP during November-December 2006 and training given to staff on its handling in February 2007. The model system can also be operated from SMHI in Sweden and discussion has started as to suitable personnel who could be trained at UNEP to run the model, but this may not be possible under this phase of RAPIDC.

In southern Africa the atmospheric transport of air pollution around the region has been well studied and phenomenon such as the Southern African anticyclonic gyre (Figure 2.8) and the 'River of Smoke' (Figure 2.9) are well documented by regional and international initiatives (e.g. the predominantly NASA funded SAFARI 2000 project).

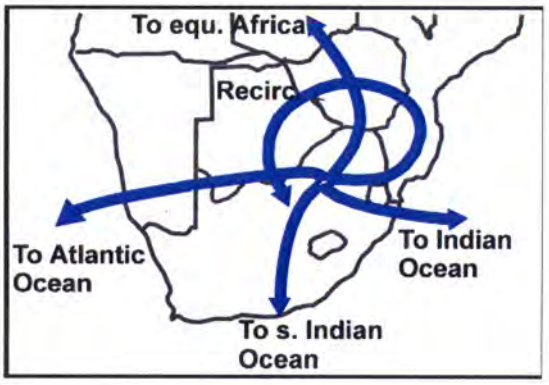


Figure 2.8 Southern African anticyclonic gyre — 5-year trajectory climatology displaying the main transport pathways of air out of the South African Highveld region (Piketh et al., 1999).

Figure 2.9 True colour image of the River of Smoke event captured by the SeaWiFIS sensor onboard the OrbView-2 platform on 4 September 2000. (Image Credits: NASA & CSIR)

For southern Africa the APINA task team on modelling has used the Comprehensive Air Quality Model with Extension (CAMX) model, as capacity already exists in the use of this model in the region. The first major deliverable by the task team in phase III is a comprehensive scoping study on the current modelling capabilities, the experience and the capacity in the various countries in the southern African region. This scoping study reveals that there is a dire shortage of qualified and experienced modellers in most southern African countries with the exception of Tanzania and South Africa. Also it was recommended and subsequently decided to train APINA members on local dispersion modelling before training them on regional modelling which is more complex. The report also explored the feasibility of establishing a centre for regional scale atmospheric transport modelling in a southern African country.

CAMX has been used to estimate ground level ozone concentrations across the southern African region in the following provisional studies. Figure 2.10 shows maximum hourly surface ozone concentrations for a 4 day period during November 2000 highlighting the geographical variation in occurrence of ozone episodes. Parts of Zimbabwe and Namibia experienced particularly high ozone episodes during which concentrations exceeding 100 ppb. This provides evidence of ozone concentrations in southern Africa above the threshold for accumulated ozone exposures which are associated with crop losses in Europe.

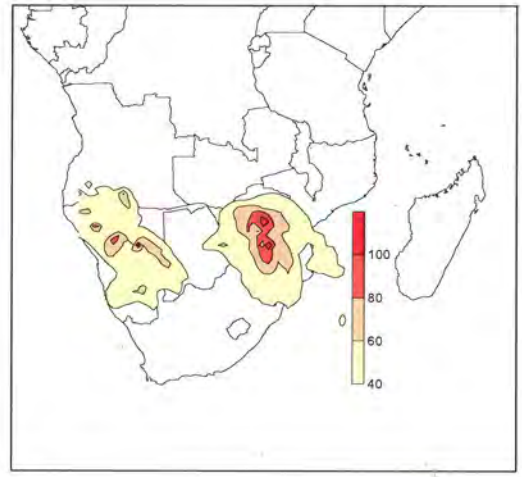


Figure 2.10 Maximum modelled 1 hour surface ozone (ppb) over southern Africa during the period 10th to the 14th November 2000. N.B 40 pbb is the current threshold above which accumulated ozone exposure may cause crop losses based on European studies.

However, to understand impacts on crops requires integration of ozone exposure over the whole growing season. Fig 2.11. uses the European approach (LRTAP Convention) AOT40 (Accumulated Over a Threshold of 40 ppb index) to indicate geographical regions where crop yield losses may be expected to occur. During the six month modelling period (which represented the main crop growth period (October to April)) Zimbabwe seemed to be the country most likely to be affected by crop yield loss. However, this modelling has only been performed for a maximum of 5 days for each of the six months for the year 2000. Hence, it is difficult to be sure the results are truly representative of the remaining 25 days of each month. Hence this work can only provide an indication of the potential for damage. For example, monitoring conducted at Maun, Botswana recorded maximum hourly ozone concentrations of approx. 150 ppb between July 1999 and Dec 2000, far higher than the levels indicated in the "snapshot" provided by Figure 2.10.

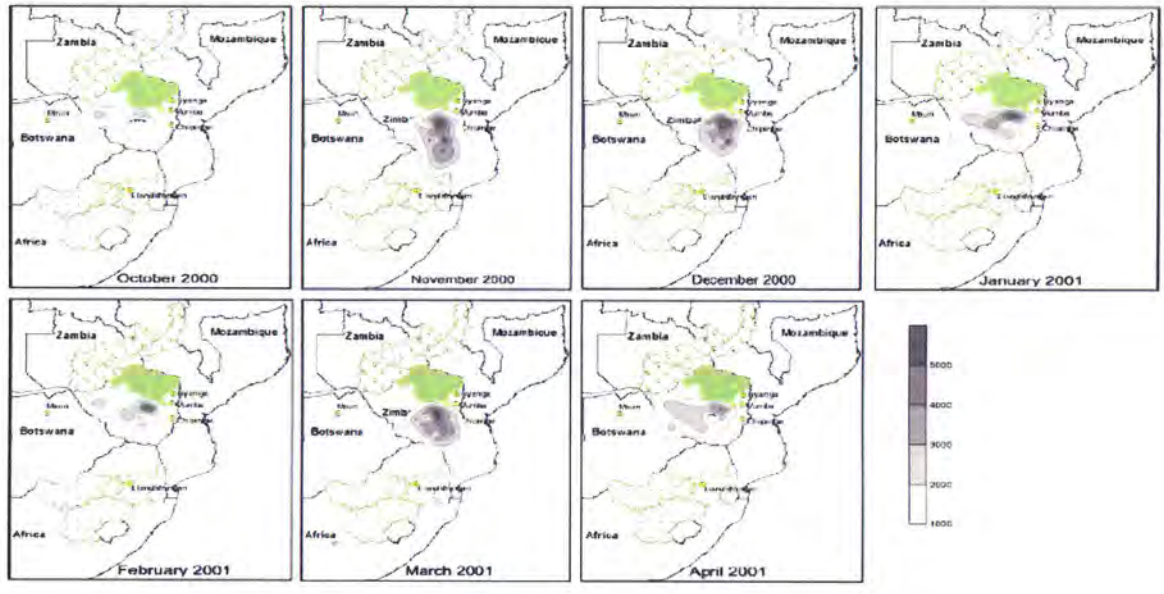
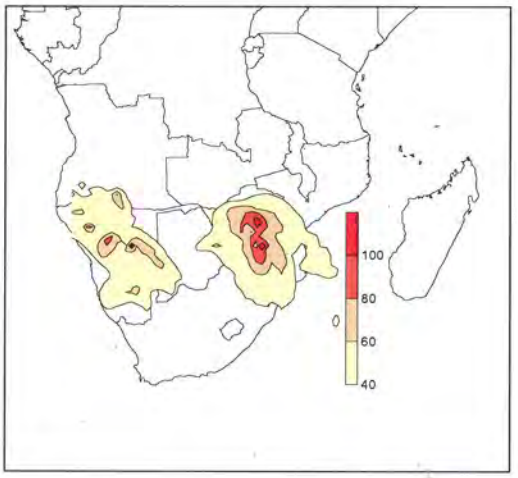


Figure 2.11 AOT40 values for southern Africa for October 2000 to April 2001, based on projecting the 5-day modelled concentrations to represent a full month (from van Tienhoven et al., 2006).



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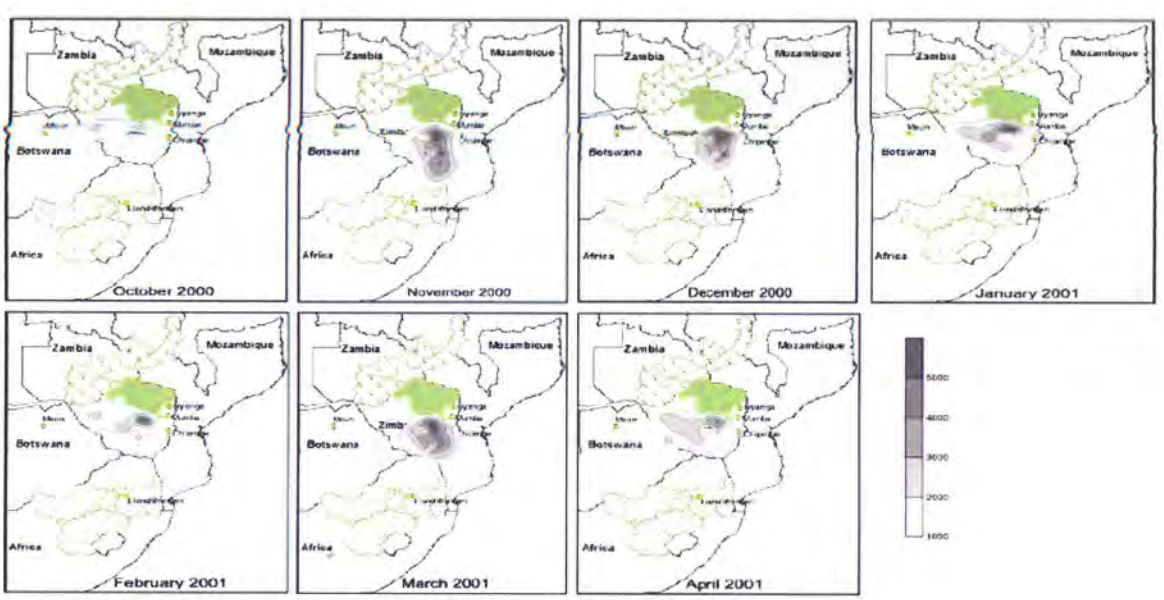

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In summary, potential exists for crops to be at risk from yield losses across the southern African region due to ambient ozone concentrations, however, further modelling and experimental research is necessary to more accurately define the geographical extent of this risk and the magnitude of the crop losses that may be occurring.

Industrial emissions of sulphur and nitrogen compounds from the South African highveld and the Zambian copperbelt, two of the major source regions, have been shown to be transported and deposited throughout the SADC region, depending on the prevailing meteorology. These two areas act as hot-spot sources for sulphur dioxide (Figure 2.12) and have resulted in the potential for acidification of precipitation in sensitive areas and ecosystems.

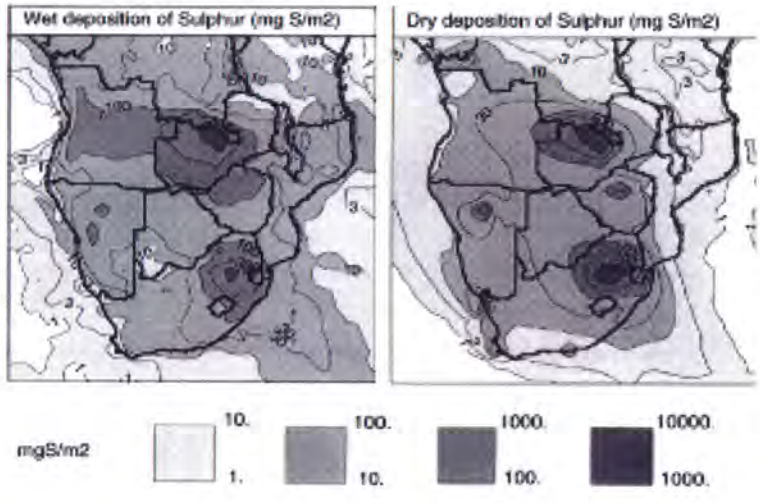

Figure 2.12 Maps showing the spatial distribution of sulphur deposition in southern Africa, in rain (wet deposition) and from concentrations of sulphur dioxide gas in the air depositing to the ground and vegetation (dry deposition). Areas of high deposition are associated with point sources such as power stations and copper smelters (Zunckel et al., 2000).

2.3.3 Monitoring - providing information about levels, trends and model validation

The estimates of atmospheric transport of different pollutants are only as good as the input data and model validity in the region. In order to test the model performance, the results need to be validated and this is best carried out against monitoring data collected at sites that are regionally representative.

Progress in the Composition of Asian Deposition (CAD) network

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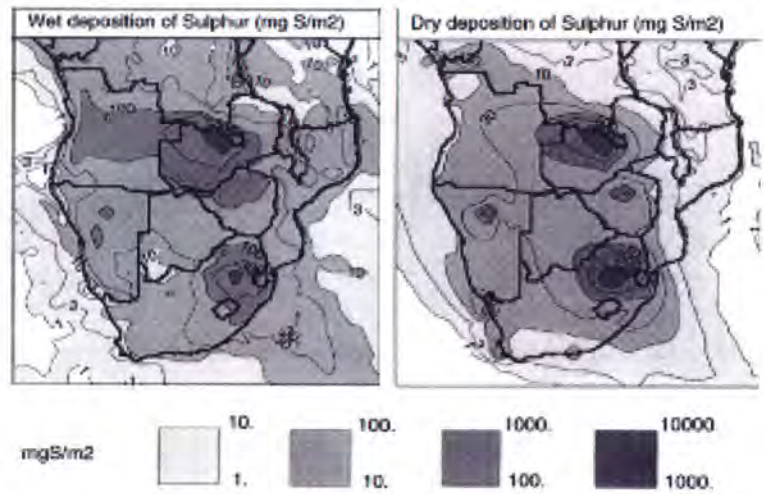

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n the early 1990s. Since then it has been producing data for sites in India of the highest international standard for rainwater chemistry and more recently for concentrations of gases and aerosols. CAD has contributed, albeit on a relatively modest scale, to capacity building for measuring rain chemistry and gaseous and particulate air pollutants in rural areas in South and Southeast Asia and has held a series of international workshops where scientists from all over the world have meet to share experience and techniques.

The CAD monitoring programme is strongly linked to the ABC and EANET programmes in Asia and the IDAF DEBITS international monitoring initiative in Africa. However, the link to the Malé Declaration network is still weak, partly because that network involves government linked institutes rather than the type of institute that CAD collaborates with (i.e. institutes where senior local scientists reside), and that little data have come out of Malé so far to trigger interaction. That said, CAD has provided substantial advice to the Malé monitoring initiative with Lennart Granat of MISU attending some of the monitoring site installations in 2003 and contributing to the development of the Malé monitoring technical manuals.

CAD has provided several instruments for collecting rainwater and aerosol samples which will remain in the ownership of the Indian partners after the completion of the project. The capacity for making chemical analyses of the collected samples is continuously improving. Pending the outcome of the ongoing international inter-comparison study (organized by EANET who invited CAD to participate) a decision will be made to transfer the analyses of samples from all Indian CAD stations to one of the Indian CAD laboratories.

Trends in sulphate, nitrate, ammonium, calcium concentrations and pH of rain from an urban CAD site in Pune, India, since before 1990 are shown in Figure 2.13. Although the accuracy of results, and type of analysis and sampling techniques applied, have varied over the years significant trends have emerged. There are significant increasing trends for SO_4 and NO_3 which could be attributed to the rise in industrial and vehicular activity during this period. Calcium, the major neutralizing component of deposition, shows a decreasing trend, mainly due to the urbanisation that has reduced the availability of open land which is a major source for calcium. Overall, this has resulted in a decreasing trend for pH. However, the average pH is still in the alkaline range due to the dominance of neutralizing potential of precipitation over the acidic potential. Importantly, similar long-term trends (7-8 years) have also been demonstrated for a more remote regionally representative CAD site at Bhubaneswar, in NE India (Henning Rodhe, pers. comm.), although there are differences, such as the increase in sulphate deposition being smaller than expected. All these CAD long-term data are presently being analysed and quality checked so that definitive statements concerning trends can be made. The variability of these data from year to year also underlines the importance of long-term datasets of at least 5-10 years for meaningful trend analysis.

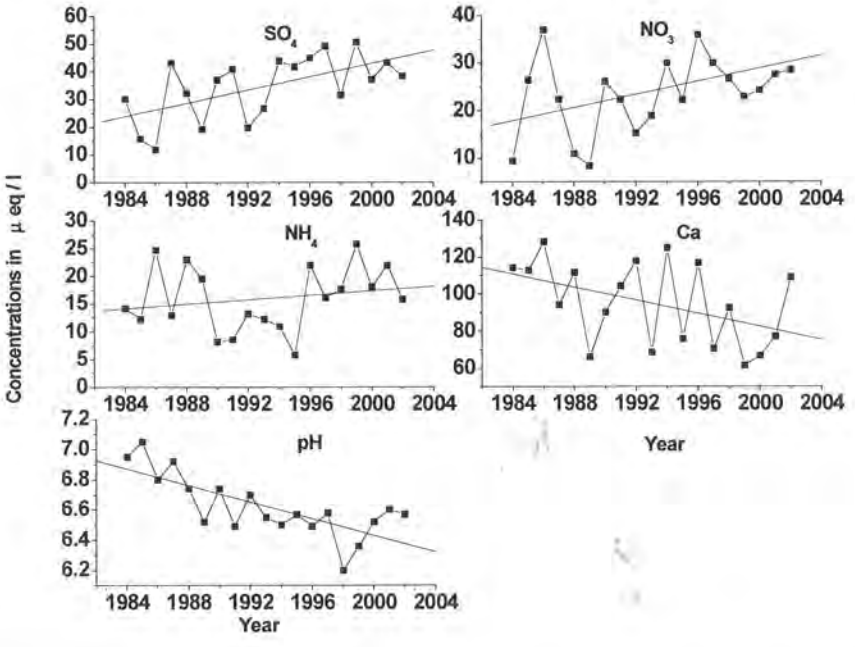

Figure 2.13 Temporal variations of pH, SO_4, NO_3, Ca and NH_4 in rain water at Pune during 1984 – 2004 from the CAD network.

MATCH model results are also available for the Pune site and they show that with current input data the model is underestimating the deposition of SO_4 and NO_3 and very much overestimating that of NH_4 in rain water (Magnuz Engardt, *pers. comm.*). These differences could equally well be artefacts of the emission inventory accuracy or the monitoring and analysis of deposition samples, and further research is required. For example, a CAD review (Kulshrestah et al. 2005) of data from nearly 100 stations in India concluded that there is a need to better assure the quality of the data with regard to sampling methods, chemical analyses and spatial representativeness. This underlines the importance of CADs activities sin the region.

One of the major conclusions of the CAD research community is that acidification is not likely to be a serious concern during the next few decades in South, South-East and East Asia – except for some areas in SW China. This is due to the alkaline nature of most Asian soils that tend to neutralize the acids formed from the emissions of sulphur and nitrogen oxides. This conclusion is based both on results from the CAD network and on research carried out in co-operation with scientists at SEI/York (see acidification section below). This result is still tentative and has to be followed up by further investigations, in particular regarding the sensitivity of soils in different regions. The most important air pollution issues in the region are probably the aerosol/health and aerosol/climate issues and the impact of enhanced surface ozone on crops. The fundamental role of atmospheric aerosols for climate and health motivates an increased focus on aerosols in a possible future phase of the CAD program.

Improving the monitoring capacity of the Malé Declaration

The main aim is to strengthen the monitoring capacities of the countries based on common methodologies and protocols. There is now a monitoring station in each country (Figure 2.14) in more remote, regionally representative, sites which may be used to validate the results of the atmospheric transport models where there were none before that were specifically linked to government.

Figure 2.14 The location of the Malé Declaration monitoring sites.

The equipment at the monitoring sites is as follows:

- IVL passive samplers for SO_2, NO_2 and ozone;
- Total Suspended Particles (TSP) and PM_{10} are being measured using high volume samplers (HVS) (regionally sourced);
- Two Bulk samplers (funnel and bottle) at each site;
- MISU wet only collector at each site with solar panel.

$PM_{2.5}$ is not currently measured, although it would be useful to measure as it is a more regional pollutant, and the Malé Monitoring Committee (MoC) are currently exploring options. The high volume samplers were originally also intended for use in short term SO_2 and NO_2 concentration measurements, but the concentrations at the sites have proved below detection limits of the monitoring equipment. This equipment was chosen by the countries as it was produced within the region and could be easily and cheaply repaired. It was considered important for the ownership of the Malé process that countries could use equipment from the region that they felt greater ownership of. In hindsight, this equipment is better suited for urban or peri-urban applications and may be best moved to more polluted areas.

Passive samplers have proved the most useful monitoring method for the Malé Declaration to date. There has always been a desire to move towards passive samplers that can be produced and /or analysed in the Malé region. Therefore, the passive sampler inter-comparison campaign is underway and the project is on track to test the suitability of different passive samplers in the region. The Pakistan and Sri Lankan NIAs are participating in the passive sampler inter-comparison, along with NBRO, Sri Lanka. Dr. Rajasekhar Bala, National University of Singapore (NUS), is leading the study and presented the proposed passive sampler inter-comparison study for the Malé Declaration, to compare the performance of different designs of passive samplers, during the regional training and refresher course in March 2007 at UNEP RRC.AP. The options available to the Malé Declaration is to have a laboratory in the region to analyse indigenous produced or commercial passive samplers or to conduct studies to find suitable alternative passive samplers that can be produced and analysed in the region. The passive sampler design, the chemical absorbent used and the quality of the laboratory

analysis are all important for obtaining good results. The proposed study will have two main components: implement passive sampler inter-comparison; and comparison of passive samplers with active samplers. The experiment is scheduled to start from June 2007.

The wet sampling equipment is installed and the countries are about to measure the concentration of anions and cations shortly. The installation of an Atomic Absorption Spectrophotometer (AAS) in Sri Lanka has been carried out. For Bangladesh, Bhutan and Nepal, the AAS have been dispatched during Oct 2006. These will allow those countries to analyse the rainwater samples. The quality control is an important aspect and the methods to be used have been developed and the laboratories primed for the task. As countries now initiate their rainwater analysis the quality control methods will start in parallel. The monitoring experts have also been trained in the methods of trajectory analysis and models that can estimate the movement of pollutants to the monitoring sites which puts their monitoring efforts into context.

The countries have placed a lot of effort in developing the monitoring sites, not without problems (e.g. monkeys removing passive samplers in Sri Lanka and the troubles in Nepal affecting communications with the monitoring site). All sites are now delivering data, but not all sites are delivering all data (see Table 2.1). A plan to ensure that all sites deliver regular and complete datasets has now been established by the MoC and is currently being implemented (see Appendix II, LFA 2 for details).

Most of the countries sent their data to UNEP for the centralised database. The Secretariat updated the data with monitoring data from NIAs and analysis of passive sampler data from IVL. The regional database is available online for the NIAs at: www.rrcap.unep.org/md/. In order to bring all monitoring sites and the analysis up to expected levels of competence, site and laboratory audits will be performed by the MoC. These are planned for most of the countries within the last year of Phase III, and audit protocols have been elaborated. A revision of the monitoring manuals will be done, based on the suggestions given in the notes presented and the discussions at the meeting in Bhutan in September 2006. For example, Standard Operating Procedures (SOP) will be introduced to improve the data quality.

To ensure the sustainability of the efforts, spare parts for all equipment have been delivered to the sites and specific training in equipment for countries has been implemented. As stated in the proposal, a number of secondary sites are being established with only passive samplers and rainwater collection in Iran, Bhutan and Sri Lanka to broaden the network. The countries continue to contribute the manpower to undertake the monitoring which enhances the ownership of the process.

The result of comparing the modelled and monitored data for SO_2 from IVL passive samplers can be seen in Figure 2.15 for the eight Malé sites. Naturally this is not a true comparison as the emission estimates are for 1995 and the data are ten years later, when presumably many of the emissions have increased. Nevertheless, the fit with of the measured and monitored data for some of the more remote sites is very good. Some of the differences deserve comment. The Port Canning data from India do not fit modelled data well, whereas for the Khulna site in Bangladesh the fit is much better. This can mainly be put down to the fact that Port Canning happens to lie within the same 1 x 1 degree grid as Kolkata, which according to the EDGAR database is a huge emitting source for SO_2. The MATCH model calculates a correspondingly high concentration for SO_2 in that grid. This is therefore an artefact of the resolution of this application of the MATCH model where if a smaller grid size were used, the fit with Port Canning data would be much better. In fact Magnuz Engardt has modelled using a smaller grid size and the fit is indeed better. Other discrepancies, according to our first

thoughts could well be a result of the emission inventory and the way in which national emissions are distributed across countries in the EDGAR estimates.

Table 2.1: Monitoring Status of the Malé Declaration Sites, April 2007

Parameter	Bangladesh	Bhutan	India	Iran	Maldives	Nepal	Pakistan	Sri Lanka
TSP	no	yes	Yes	Yes	No	Yes	No	No
PM_{10}	no	No	Yes	Yes	No	Yes	No	No
SO_2, NO_2, O_3 with passive sampler	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SO_2, NO_2 with active method	no	Yes	Yes	Yes	No	Yes	No	No
pH (rain water)	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
pH (Surface water)			Yes					
EC	Yes	Yes	no	Yes	Yes	Yes	Yes	Yes
Rain Chemistry (Mg^{2+}, Na^{+}, K^{+}, Ca^{2+}, NH^{4+}, SO_4^{2-}, NO_3-, Cl-)	no	no	yes	yes	no	No	no	Yes

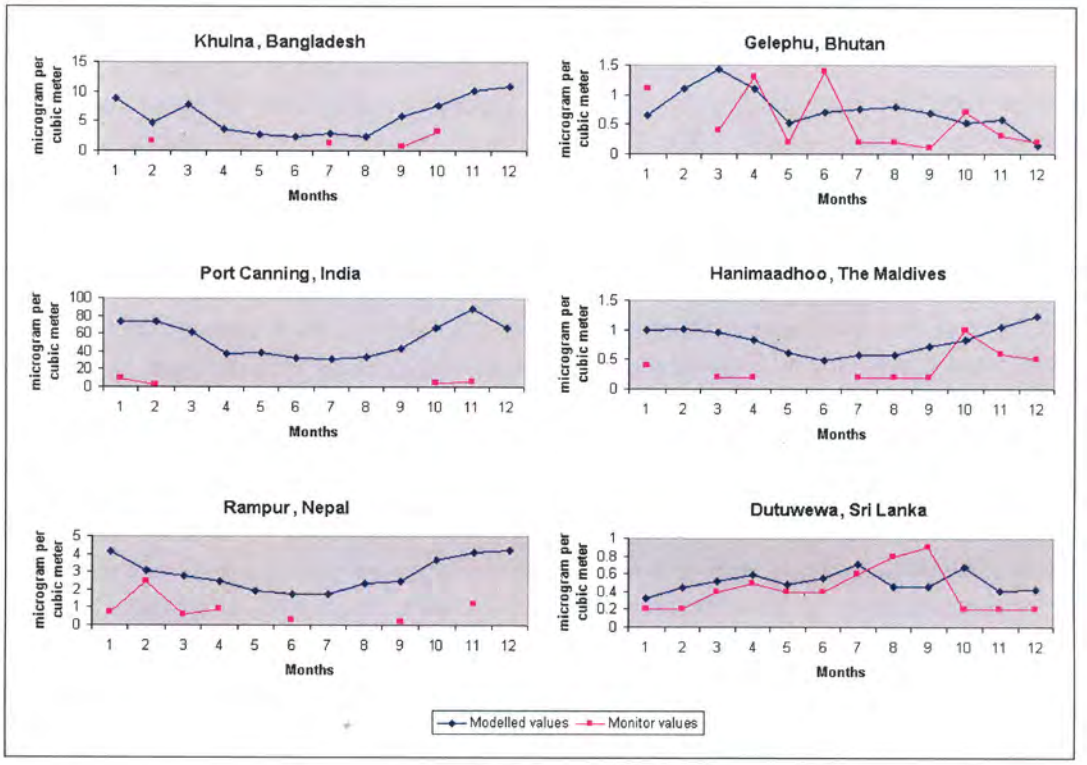

Figure 2.15 Comparison of the SO_2 and NO_2 concentrations from the Malé Declaration monitoring sites and the results from the MATCH model using 2000 weather data and 2000 EDGAR emission estimates.

Ozone monitoring has been introduced using IVL diffusive samplers which were sent to all countries in April/May 2006. Ozone data has already been received from all the countries and will help to validate the MATCH model results, such as those shown in Figure 2.7.

From the monitoring data in South Asia, the picture emerging is that the modelling data seems to be producing reasonable results compared to the monitoring data. The monitoring sites are now producing more data more regularly and so the opportunities for further comparison will increase. As the emission data becomes accessible this can be used as input to the model and so this will mean that a more recent estimate will be used which will make the comparisons more accurate.

APINA monitoring enhancements

Despite a number of the monitoring efforts, there is currently no coordinated approach within APINA member countries for validation of the data or dissemination of the collected information for direct input into strategies addressing air pollution problems. An APINA scoping report is focusing on opportunities for APINA to collaborate with existing monitoring initiatives in the region, to fill gaps in knowledge and provide much needed monitoring data for air pollution impact studies. The aspiration is to be able to make high quality measurements of air pollutants that could be reliably compared across the region and this is being addressed in the plans for Phase IV.

2.3.4 Building the capacity of national organisations to study impacts

The impacts of air pollution provide the impetus for policy development. Air pollution can affect people directly – through breathing unhealthy air – and indirectly – by damaging the environment in which they live. As well as serious impacts on human health, other important air pollution impacts include: damage to natural vegetation and crops, compromising ecosystem services and food security, corrosion of man-made materials and cultural heritage, acidification of soils, lakes and streams, excessive and harmful nutrient growth in water bodies, and degradation of visibility. In all of these ways, air pollution contributes significantly to the downward cycle of poverty around the world, with the poorest communities being those most affected. The RAPIDC programme now has a comprehensive set of activities to build capacity in the regions for the assessment of these impacts to inform air pollution prevention and control options. There is an emphasis on the generation of regionally specific information as experience shows that it is not sufficient for policy makers to be told only of the experiences of other regions such as Europe and North America.

Impacts on health

The health impacts of air pollution are the major policy driver for decision makers of developing countries. The work in Phase III in South Asia and southern Africa has concentrated on training in health impact assessment methods and accessing relevant information.

One application of a simple epidemiological study is on-going in Dhaka, Bangladesh, to demonstrate the relationship between the bronchial health of asthmatic schoolchildren and air pollution. This relationship is generally known internationally, but the study is designed to highlight what is happening in Dhaka, so that it is not just a textbook example. The study has started and is on track to deliver results (Figure 2.16). Other countries are also interested in undertaking similar studies (Pakistan has expressed an interest) and, if successful, the plan is to apply the study in southern Africa in the next phase. Such simple methods can be widely applied across the regions to demonstrate the damaging impact of pollutants, and in particular the high particulate matter concentrations.

Figure 2.16 School pupil in Dhaka, Bangladesh (April 2007), participating in the Malé Declaration health study on the link between particulate matter air pollution and the bronchial health of asthmatic schoolchildren (Photo: Patrick Büker, 2007)

The regional assessment capacity is being strengthened through regional training workshops, two have already been held in southern Africa and one has so far been held in South Asia. The health capacity building project for the Malé Declaration and APINA has brought together regional expertise in medicine and air quality assessment from Bangladesh, Bhutan, Iran, Maldives, Nepal, Sri Lanka and Thailand in Asia, and Botswana, Malawi, Mozambique, South Africa, Tanzania, Zambia and Zimbabwe in southern Africa The RAPIDC health technical advisors (Prof. Dieter Schwela of SEI and Frank Murray of Murdoch University, Australia (both formerly at WHO) are providing training in the following areas:

1. Simple methodologies and epidemiological studies for use in the assessment of impacts of air pollution on health;
2. Collation of regional information provided by the participants on studies conducted in their countries;
3. Discussion of regional issues, sources, ambient concentrations, control policies, impacts on health and implications for the region, with use of the integrated excel based model SIMAIR;
4. Discussion of the information needs of decision-makers in the region, how the information can be obtained, methodologies, resources, and regional collaboration to provide the information required.

The significance of the project is that it directly addresses many of the key issues for policy-makers concerning air pollution. It addresses: Why should we take action to reduce emissions? What do we know about impacts on health in my country? Can we quantify adverse impacts of air pollution on health in my country? By strengthening knowledge and skills among key government officers about effects of air pollution on health, and by building partnerships among similar officials in the region, progress to implement actions to reduce the adverse impacts of air pollution on health is being catalysed.

Impacts on crops

Under RAPIDC, the Air Pollution Crop Effects Network (APCEN) is coordinating a global network of scientists devising common approaches for experimental and modelling assessments. It is responsible for coordinating the pilot studies for the experiments being undertaken in Malé and

APINA countries and is developing experimental protocols. The network of scientists has met in 2006 and another meeting is planned in 2008.

The capacity to understand the impacts of air pollutants on crops in South Asia and southern Africa has been strengthened through the application of internationally recognised methods (in particular from the LRTAP Convention), often promoting crop impact work for the first time in some of the countries. The impacts of air pollutants on crop yield, particularly by ozone concentrations, have been highlighted by training and a number of experiments and through use of atmospheric transfer models (see above) in Asia and southern Africa.

The Malé and APINA crop assessments currently being carried out in the regions include: i) growing clover clones, one sensitive and one insensitive to ozone and measuring the difference in yield and ii) using EDU (ethylene diurea) which protects crop plants from ozone.

In APINA, six countries are participating in the study and a pilot study was developed under the APCEN network at the University of the North West, Potchefstroom, South Africa. The results of the pilot in Africa were promising with the characteristic chlorotic (white) spots caused by ozone appearing on the leaves of the sensitive clone (Figure 2.17). The ozone sensitive clover plants showed approximately 20% biomass loss in comparison to the ozone resistant plants. This would imply that the critical levels for natural vegetation and many crops might well be exceeded in this region, if the clover plants respond in the same way to the combined climatic conditions and ozone exposure in South Africa as they do in Europe.

Figure 2.17 Visible injury (white rash of spots at edge of leaf) on leaf of sensitive white clover clones at pilot site in South Africa (Smit, pers. comm.)

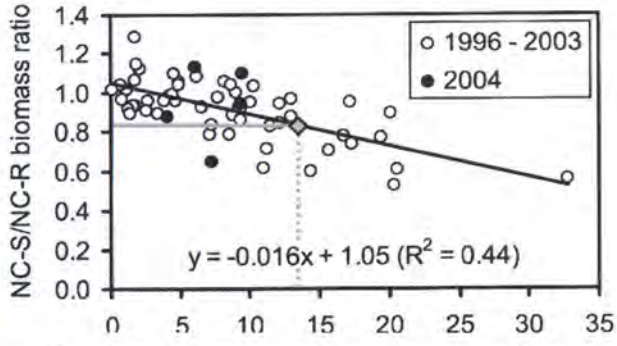

Figure 2.18 Dose-response relationship for white-clover (from Europe), the diamond indicates the sensitive/resistant biomass ratio from South African pilot study and the dotted line an estimate of the ambient AOT40 level according to European data (Smit, pers. comm.)

Five countries in South Asia (Bangladesh, Pakistan, India, Sri Lanka and Nepal) are also participating in the biomonitoring experiments but the results are not yet available. The choice of participating countries and institutions has taken a lot of time. Initially the pilot study was planned to take place in India, but the import permit for the clover clone plants to India has not yet been granted and so it was decided to carry out the pilot study in Pakistan instead. India will still participate in the study if and when the permit becomes available. The first combined training for Malé countries will be in August 2007, but there has been individual in-country training for some of the countries that have been selected for the biomonitoring studies that requested assistance from the technical advisors (Bangladesh, Nepal and Sri Lanka).

The chemical protectant study was piloted by APCEN in 2006 in Varanasi (India). This study used mung bean (*Vigna radiata* L.) as a bio-indicator since this species is known to be O_3-sensitive and of economic importance in South Asia. The results show that the ozone concentrations in Varanasi were high enough to substantially reduce the number and weight of seeds and pods (by about 50%), the leaf area and the total plant length (also by about 50%) of mung bean (Figure 2.19). The chemical protectant study is now being applied in Pakistan and in India as part of the Malé implementation plan. Additional species and varieties of potato, spinach, tobacco and wheat will also be assessed for their suitability for use with this experimental technique. It is planned that a pilot chemical protectant study will also be conducted at the University of the North West, Potchefstroom, South Africa, for APINA.

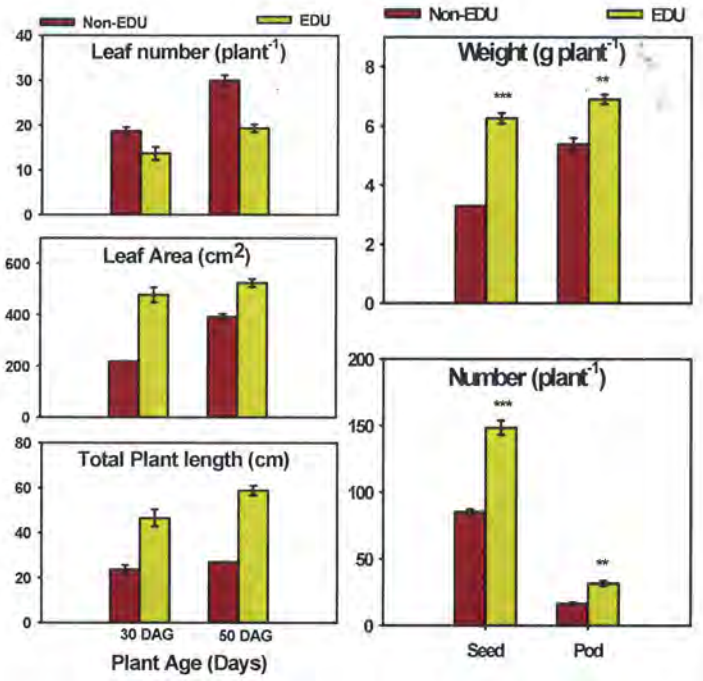

Figure 2.19 EDU effect on mung bean plants exposed to ambient in Varanasi (India) in 2006

Impacts on ecosystems

Air pollution such as the wet and dry deposition of nitrogen and sulphur compounds has the potential to cause acidification of ecosystems and impacts on ecosystem biodiversity through both eutrophication and acidification effects. Ozone impacts can also further affect biodiversity of natural vegetation. In southern Africa and South Asia there is still no conclusive evidence of these impacts on natural ecosystems and there is lack of comprehensive studies but there is concern for certain sensitive areas as emissions continue to increase in both regions.

The study of impacts of air pollution on ecosystems in the Malé region is a small project within RAPIDC Phase III and the main focus is assessing acidification risks in our regions. Acidification is clearly a regional and potential transboundary issue and so important in the context of regional policy cooperation on air pollution. In 2001 MISU and SEI publishes a joint paper that showed the sensitivity of soils to acidic inputs in South Asia (Figure 2.20).

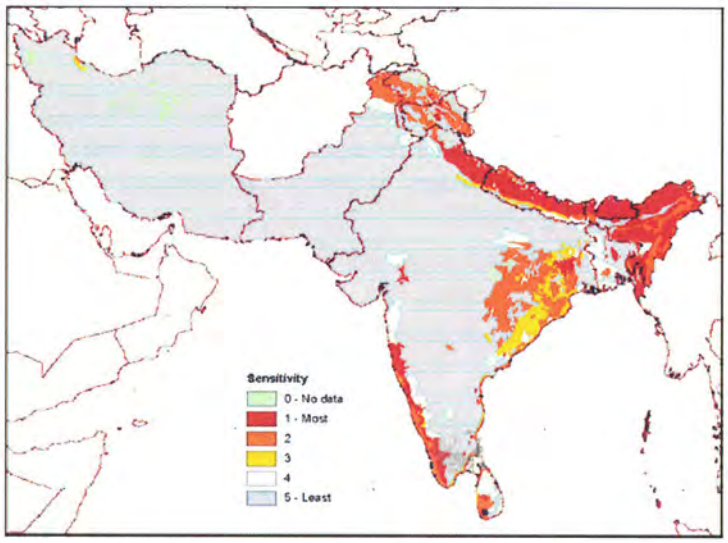

Figure 2.20 The sensitivity of South Asian soils to acidic deposition inputs (Kuylenstierna et al,. 2001)

Recent results from work carried out by MISU in collaboration with SEI on the risk assessment of acidification over time in Asia, which combines the best available data on acidic deposition inputs (e.g. from the CAD network) and ecosystem sensitivity, is shown in Figure 2.21 The results show that there are limited areas in South Asia at risk from acidification (e.g. Western Ghats, parts of Sri Lanka and the Himalayan region) and that it may take some considerable time for any changes to be observed. This is consistent with a general lack of observed acidification in the region.

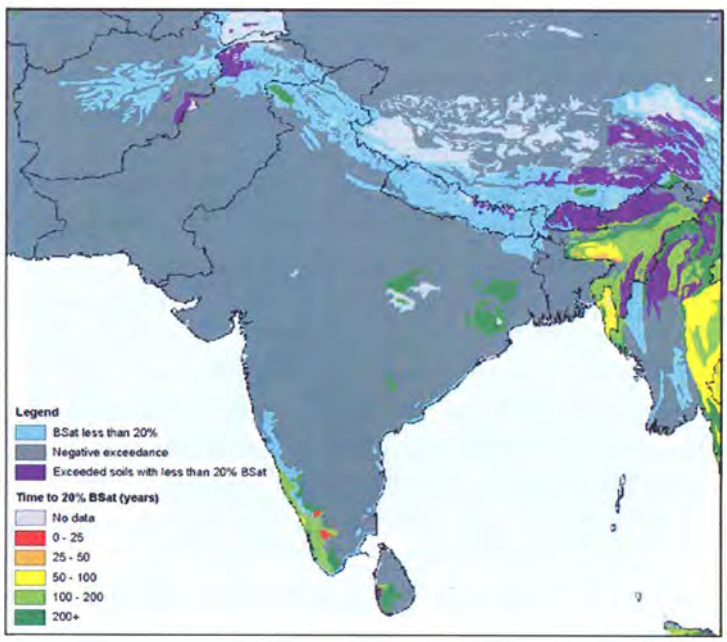

Figure 2.21 The time development of damage of soils in South Asia according to a simple regional modelling approach using coarse datasets. Purple designates soil already at risk, grey no risk, other colours estimate the number of years until acidification impact may be observed.

It must be stressed that this map has been produced using very coarse, low resolution, datasets and further research is required to verify the results on the ground at local level. The results basically underline the importance of further research to improve estimates of wet and dry deposition of SOx, NOx, NHx and base cation deposition in Asian conditions, and their future trends, as well as improved understanding of soil weathering rates and buffering capacity and the implications of different ecosystem management practices. But, even so the results do suggest, as concluded by the CAD network meeting in Hyderabad in 2006, that acidification may not be as big a problem in South Asia as it was in Europe.

Such assessment methods will form part of the training which is planned for the last part of Phase III for the Male countries; however the risk assessment has already been used in various training meetings, especially in relation to the Integrated Information and Assessment System of the Malé Declaration. This work is also strongly linked to the monitoring and assessment activities of the CAD network.

In southern Africa there is also little scientific capacity to address the challenges facing natural ecosystems that are caused by air pollution, as most scientific attention is focussed on issues of crop production and food security. The current extent and impact of air pollution on natural ecosystems, especially biodiversity hotspots in Southern Africa, is poorly understood and the future development of these problems, including the required policy responses, is unclear. APINA is currently producing a scoping report on this issue.

Impacts on corrosion

The Corrosion Network (CORNET) is a global network funded under RAPIDC and is developing the experimental protocols for use in Asia and Africa and combining the results of the corrosion exposures which are being carried out under CORNET, the Malé Declaration and APINA. The capacity to understand the air pollution impacts of corrosion has been significantly increased through the RAPDIC activities in both Asia and Africa, as well as the capacity to undertake assessments. This impact had been little known and RAPIDC has significantly increased its profile in science-policy circles in these Asian and African regions. The corrosion racks have been positioned in the 5 countries in southern Africa (Mozambique, South Africa, Tanzania, Zambia (2 sites), Zimbabwe) as part of the APINA initiative and in 4 countries of South Asia (India (Taj Mahal), Iran, Nepal, Sri Lanka) as part of the Male Declaration Implementation (the Maldives and Bangladesh have also requested to join the network of sites). These complement the eight countries across Asian that are also part of CORNET. The training in the setting up of the racks and in the use of the results has taken place and the results of the corrosion, with measured pollutant concentration will be available at the end of the Phase III. Preliminary results for monthly mean SO_2 concentrations measured at the CORNET sites across Asian and southern Africa and the amount of corrosion damage measured in year one and two at the sites is shown in Figures 2.22 and 2.23. The final dataset will be very impressive and useful, and its completeness already rivals a sister network in Europe under the LRTAP Convention. Mean data, from a mixture of urban and rural sites, will include: temperature, relative humidity, amount of precipitation, pH, HNO_3, SO_2, NO_2, O_3 and total mass of particulate deposition (all gases and PM measured by IVL passive samplers). Materials exposed include: carbon steel, painted steel, Portland limestone, zinc, and copper.

The dose response relationships will by the end phase III be more robust and will be able to answer the question as to whether the corrosion in the tropics and sub-tropics occurs faster for a given pollutant concentration than in European climates may be answered. In any case the fact that the

linkage between air pollution and corrosion rates with the associated economic losses will be powerful messages to the policy makers of the countries concerned.

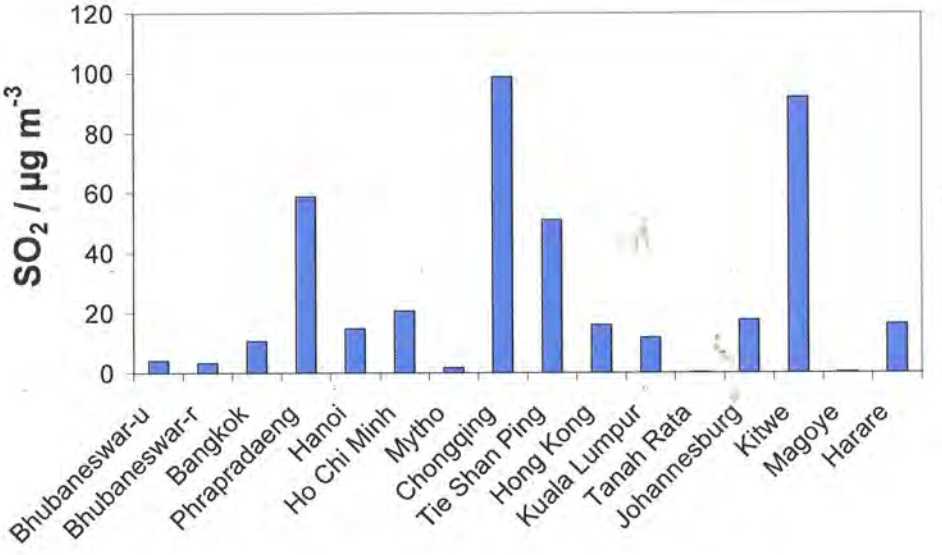

Figure 2.22 Monthly mean passive sampler data (from IVL) for SO_2 concentration at CORNET sites across Asia and southern Africa.

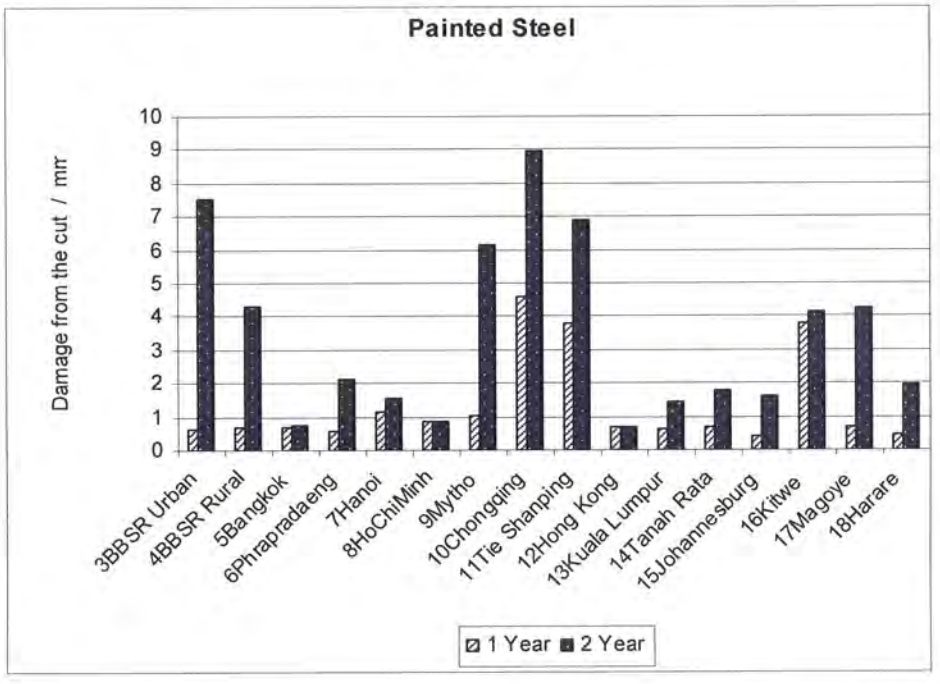

Figure 2.23 Degradation of painted steel after 1 and 2 years of exposure at CORNET sites across Asia and southern Africa.

The Malé Declaration and CORNET jointly organized a training workshop on the evaluation of corrosion on materials during October 2006. The workshop was followed by a meeting of CORNET.

There were 30 participants in the workshop: 9 from Malé Declaration countries (Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan, Sri Lanka), 9 from CORNET countries (Hong Kong, Vietnam, China, Malaysia, Thailand), 5 from APINA network, African countries (Mozambique, Tanzania, Zimbabwe, Zambia) and others from collaborating institutions. The workshop was aimed at capacity building in eight Malé Declaration countries and other participating countries for studying the evaluation of corrosion of air pollution on various materials and consequently enabling them to design science-based policy options to mitigate air pollution and its adverse effects on materials.

Four new test sites were established and exposure started in the fall of 2006 with planned withdrawal of specimens in the autumn of 2007 (Katmandu, Nepal; Agra, India; Battaramulla, Sri Lanka; Teheran, Iran). Ten corrosion kits were erected in Katmandu, Nepal in the fall of 2006 with planned withdrawal of specimens in the fall of 2007. The evaluation of trend results is on-going and partly completed.

2.3.5 Understanding the efficiency of measures and policies

The knowledge of the emissions, transfer, pollutant levels and impacts should all feed into the policy making process to emphasise the need for action, but in addition to that there is a need for information about the solutions to the air pollution problems, their ease of implementation and efficacy. Therefore in both APINA and in the Malé Declaration there are activities to see how the information can be best synthesised and transferred. Partly, a synthesis of policy approaches from the international arena has been developed and training in these options has taken place. In addition to that, the experience in South Asia is also being synthesised and a further activity will investigate the factors that affect how well policy interventions work in the social and political contexts of the different countries in that region. It is intended that these syntheses and training will increase the capacity of the NIAs and NFPs about the different approaches that are possible to reduce and limit the air pollutant emissions from different sectors.

At the urban scale the Air Pollution in Megacities of Asia (APMA) project has produced a compendium of the Air Quality Management (AQM) for 20 Asian cities together with CAI-Asia and analysed their capabilities and required enhancements. This shows great variation in capacity across Asia and illustrates the very high pollution levels from monitoring data compiled for the cities. The implementation of the AQM strategic framework (SF) developed by APMA will be undertaken in Phase III for Kathmandu in support of the Malé rapid urban assessment and in Karachi to improve their capacity. This will involve direct consultation with the various stakeholders involved in AQM in these South Asian cities and represents a revision of APMA activities in this phase so that its activities become more integrated with the rest of RAPIDC. Contingency funds allow, a similar AQM SF will be developed in conjunction with the APINA RUA in consultation with the city council and related stakeholders in Maputo, Mozambique.

IIAS

The different pieces of the knowledge jigsaw required by policy makers in the Malé region are being put together in the Malé Integrated Information and Assessment System (IIAS). In this system the emissions are linked to the results of the atmospheric transfer model to give depositions and concentrations. These can be compared within the system with the results of the monitoring. The regional impacts of the concentrations and deposition are estimated. Finally the different policy instruments are linked to the emission estimates. In addition, all of the reports and methods are easily accessible from the system which therefore combines all information in one place. Some of the work is completed and some is yet to be done to get all building blocks in place. This has been developed

with the requirements specified by the NIA representatives. It has been used in some of the training sessions to show the result of combining the information from the different parts of the Malé Declaration implementation.

Communicating messages to stakeholders

It is important that the knowledge and messages developed in RAPIDC are efficiently transferred to the relevant stakeholders, and particularly to the relevant policy makers. Through the design of APINA and the Malé Declaration the policy makers are already involved in the process, agree the workplans and discuss the results. Therefore the process itself encourages transfer of information between the scientists from the region and elsewhere to policy makers.

The promotion of the RAPIDC programme is accomplished via the website and downloadable fact sheets. These are in the process of being updated at the moment. Many of the communication activities are devolved to the regional initiatives – to APINA and the Malé Declaration targeting a broader audience in their regions. This is partly accomplished through the development of newsletters and then through stakeholder involvement in workshops and national initiatives. For example, in the Malé Declaration there is an annual regional stakeholder meeting and there are a number of national stakeholder meetings planned. Dissemination is also be conducted through youth groups such as South Asia Youth Environment network (SAYEN), and major air pollution related events such as BAQ and Saltsjöbaden III. SAYEN also include media networks such as Environment TV as part of its network. A multimedia awareness package will be completed and disseminated before the end of this phase.

Many of the communication activities are devolved to the regional initiatives – to APINA and the Malé Declaration targeting a broader audience in their regions. This is partly accomplished through the development of newsletters and then through stakeholder involvement in workshops and national initiatives. For example in the Malé Declaration there is an annual regional stakeholder meeting and there are a number of national stakeholder meetings planned.

3. Ownership and handover of RAPIDC in Phase IV

In response to the desire to shift responsibility for RAPIDC and its component parts to partners in Asia and Africa, changes have been made to the management of RAPIDC during Phase III. The most significant move has been to create a Programme Management Committee (PMC) who manage the programme, even though the responsibility for the programme to Sida remains with SEI for this phase. One deliverable for Sida was a document outlining how the ownership of RAPIDC has developed over time and what the process is for the transfer of ownership in the next phase should be. This was undertaken and submitted in June 2006 and there has been discussion with Sida, within the PMC and with country representatives regarding this issue. The main conclusions are outlined in the following paragraphs:

- Ownership is defined as the 'owners' being in control of the work plan, development of the different aspects of the programme and the administration of the programme. The process of transfer of ownership is one where the further development of new proposals and the implementation of the work plans that result are fully under the control of the owners, and that the administration that has been undertaken by SEI in terms of its contractual obligations to Sida (e.g.

responsibility to Sida for the activities, reporting and financial administration, information and outreach) are effectively transferred to the Secretariats of the Malé Declaration and APINA and the coordinators of the different air pollution networks.

- The development of the RAPIDC programme from 1992 has seen a progressive increase in the degree of ownership of the activities in developing country regions. Initial ideas for the programme in the early 1990s came from the experience of Swedish institutions and in these initial networks (such as CAAP) there was always a significant degree of participation and ownership by Asian institutions, which has been increased in recent years.
- The process of project development ensured that the RAPIDC programme focus for capacity building of these processes responded to requests from the regions and received appropriate consultation and approval from the regions. The increase in ownership of the process of RAPIDC development has emerged from the maturing of the Malé Declaration and APINA and the increase in their responsibility for developing the work plans in Phase III (2005-8) of the Programme.
- Although UNEP, SACEP, IES and UNZA are coordinating the Malé Declaration and APINA the 'owners' are the governments participating in the Malé Declaration and members of APINA. The countries of South Asia (Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan and Sri Lanka) own the Malé Declaration and are represented by their nominated National Focal Points and National Implementing Agencies (NIAs). The work plan for Phase III is fully owned by the APINA members which include government representatives of the seven southern African countries involved (Zimbabwe, Zambia, Tanzania, South Africa, Mozambique, Malawi and Botswana) and also scientific institutions, private sector representatives and NGOs.
- *Programme and work plan development:* For Phase IV, the development of the RAPIDC programme as an integrated whole, previously undertaken by SEI, will become the responsibility of the PMC.
- *Malé Declaration proposal process:* The proposal will be developed by UNEP and SACEP together with the Malé country NFPs and NIAs, using technical advisors as required, and there needs to be cross-linkages to the proposal development of APINA and the RAPIDC science-for-policy networks. It is proposed that for the development of the Phase IV workplan that UNEP and SACEP will consult with the countries about the Work Plan, develop the work plan with help from technical advisors and submit the proposed work plan to the Malé Declaration inter-governmental meeting in 2007 for approval.
- *APINA proposal process:* the proposal will be developed by the IES and UNZA together with the APINA members using technical advisors as required, with the APINA NFPs in the ministries of environment taking an active role in setting the agenda. The proposal development needs to be cross-linked to the processes being followed by the Malé Declaration to enhance South-South cooperation. The proposed work plan developed through this consultation process will be tabled, discussed and agreed upon at an APINA annual meeting in 2007.
- *Network process:* The proposals will be developed by the coordinating institutions using their Steering Committees in consultation with their network members using technical advisors as required and cross referencing strongly to the Malé and APINA proposal development.
- *Structure of the Phase IV programme:* The PMC feels that the final proposal will have three separate parts: APINA, Malé Declaration and science for policy networks. These three sections would be submitted to Sida as a combined and integrated programme under the framework of

RAPIDC. The PMC would coordinate this submission and ensure integration. The proposal would need to be developed and submitted during 2007, with an anticipated start date in 2008.

- *Implementation of the work plans*: the secretariats of APINA and the Malé Declaration will be responsible to Sida for the successful implementation of the work plans developed in the Phase IV proposal. This will include contractual arrangements, financial administration, coordination of meetings, information and outreach, and reporting. SEI will undertake capacity building for SACEP, UNEP, IES and UNZA, as well as for the coordinators for the networks, by describing the coordination role that SEI has undertaken for the RAPIDC programme.

- The current PMC feel that the management of Phase IV of the programme by such a committee is the best solution for RAPIDC and the TAC should be further developed as an advisory body to the regional initiatives. There needs to be representation from the Malé Declaration and it is proposed that this should be UNEP and SACEP, as it is at the moment; representation for APINA and this be undertaken by IES and UNZA, as it is at the moment and, in addition, the networks need also to be represented. SEI should act as an advisor on the PMC

- In Asia, the Malé Declaration will have one contract holder with Sida for those activities related to the Malé Declaration. The participating institutions and individuals will be sub-contracted by the Sida's contractor. SACEP and UNEP agreed that the modalities of the functioning of the secretariat was to be decided by the governments who own the Malé Declaration. At the Inter-governmental meeting held in Bhutan in 2006 the countries there were unanimous in stating that they wished UNEP to remain as secretariat supported by SACEP and also that they wished SEI to stay involved.

- In Africa IES will continue to be the secretariat of APINA and will be the contractual partner with Sida and hold the contracts for all activities. IES has been the institution where capacity for management of APINA has been built in the region and APINA has developed regardless of who has been the director (first it was Bruce Campbell followed by Sara Feresu). IES's main contractual partner will still be UNZA where the Coordinator of APINA sits. Other collaborating institutions will be sub-contracted by IES. All reporting on the progress on activities will be submitted to the Coordinator and the secretariat who will compile half yearly and yearly reports for submission to the PMC. National stakeholder meetings will be part of the process at which countries will discuss APINA activities and results and make an input to the regional process.

- Sida has responded to the ownership document and stated that they would like to see more evidence of financial contributions from the regions as an indicator of increased ownership of the regional processes. Sida has also said they ideally want two contract partners – one for Africa and one for Asia. The PMC suggests that the funds for APMA and CAD network activities that form part of RAPIDC be placed under the Asian contract partner and that APCEN and CORNET, for the purposes of RAPIDC funded activities, be placed under the African contract. It is also clear that SEI's future role will be as an advisor to overall RAPIDC development on the PMC, as advisor to the Malé Declaration and APINA networks and also as part of the technical capacity building effort in the activities undertaken as requested by those networks.

4. Finances and programme administration

There are no significant deviations from the workplan and the programme as a whole is developing as envisaged in the proposal. The full RAPIDC budget is shown in Table 3.1 below. The total RAPIDC budget for the period 2005-2008 is MSEK 46,790 divided between Asia (MSEK 33,490) and Africa (MSEK 13,300).

Table 3.1 RAPIDC Budget Phase III

	Asia (SEK)		Africa (SEK)		TOTALS (SEK)
Activity	Fees	Reimbursables	Fees	Reimbursables	
Malé Declaration	14970000	9 180 000			24 150 000
APINA			4 660 000	5 570 000	10 230 000
CAD	720 000	890 000			1 610 000
APCEN	580 000	360 000	370 000	220 000	1 530 000
CORNET	610 000	400 000	390 000	140 000	1 540 000
APMA	1 430 000	80 000			1 510 000
RAPIDC Management	2 460 000	360 000	1 110 000	30 000	3 960 000
Contingency	1 120 000	330 000	430 000	380 000	2 260 000
Total	21 890 000	11 600 000	6 960 000	6 340 000	46 790 000
TOTAL		**SEK 33 490 000**		**SEK 13 300 000**	**SEK 46 790 000**

The disbursement prognosis (as requested by Sida) for 2006 was MSEK 14.5 M SEK. By December 2006 SEI had invoiced Sida 12.9 M SEK. However, another 1.8 M SEK of the 2006 expenditure has, means that the 2006 disbursement target was met (slightly exceeded by 0.2 M SEK). The budget pull-downs for both Africa and Asia are on track according to this prognosis.

Table 3.2 Disbursement in 2006 compared to projected disbursement

	Disbursement prognosis for 2006	Actual 2006 disbursement	Balance
Asia Total	**10,500,000**	**10,279,450**	220,550
Fees		6,337,077	
Reimbursables&Equipment		3,942,373	
Africa Total	**4,000,000**	**4,458,571** -	458,571
Fees		2,071,693	
Reimbursables&Equipment		2,386,878	
Total	**14,500,000**	**14,738,021** -	238,021

Table 3.3 shows that the total expenditure for RAPIDC phase III activities up to 30th April 2007 was 20.8 MSEK (46%). Advance payments, not utilised as yet, to UNEP RRC.AP (Malé Declaration), SEI and IES are not included in this total expenditure but are shown beneath Table 3.3. UNEP and IES have not yet invoiced their expenditure covering the period from January 2007 to April 2007, so these amounts are not included in Tables 3.3-3.5. UNEP and IES have promised to send the invoices to SEI-Stockholm as soon as is possible, however, they have sent estimates of recent expenditure: UNEP 1.1 MSEK; 0.9 MSEK.

Tables 3.4 and 3.5 show the budget spends for activities in Asia and Africa up until 30 April 2007. In Asia, the accumulated expenditure will be 14.4 MSEK (45% of the total budget) by 30th April 2007, without including the advance of 3.5 MSEK. APMA has only spent 10% of the budget, but as explained in the APMA report in Appendix 3, the planned activities will use the entire budget before Phase III ends in 2008.

For Africa, total expenditure of 6.4 MSEK (50%) will have been reported and invoiced to Sida by June 2007 (8.1 MSEK in total will have been invoiced to Sida by June but this includes the advance of 1.75 MSEK).

Table 3.3 RAPIDC Phase III total expenditure up to 30 April 2007

RAPIDC Phase III 2005-2008					
Currency SEK	Total Budget	Earlier invoiced	This invoice	Accumulated expenditure	Balance
Total	**44,731,880**	**20,702,211**	**5,313,582**	**26,015,793**	**18,716,088**
Total Minus Advance		**15,452,211**		**20,765,793**	
Total Asia	**32,034,493**	**14,697,478**	**3,191,907**	**17,889,384**	**14,145,109**
Total Asia Minus Advance		**11,197,478**		**14,389,384**	
Fees	20,776,780	7,404,639	2,400,756	13,055,394	7,721,386
Fees - SEI and UNEP Advance		3,250,000	0	3,250,000	
Equipments	2,706,830	1,098,805	184,360	1,283,165	1,423,665
Equip - SEI and UNEP Advance		0	0	0	
Reimbursables	8,550,883	2,694,034	606,791	3,550,825	5,000,058
Reimb. - SEI and UNEP Advance		250,000	0	250,000	
Total Africa	**12,697,387**	**6,004,733**	**2,121,675**	**8,126,408**	**4,570,979**
Total Africa Minus Advance		**4,254,733**		**6,376,408**	
Fees	6,390,814	2,150,919	1,299,764	4,938,183	1,452,630
Fees - SEI and IES Advance		1,487,500	0	1,487,500	
Equipments	385,510	4,600	94,846	99,446	286,064
Equip - SEI and IES Advance		0	0	0	
Reimbursables	5,921,064	2,099,214	727,065	3,088,779	2,832,285
Reimb. - SEI and IES Advance		262,500	0	262,500	

Note: Advances to UNEP not yet used = 500 000SEK; to SEI not yet used = 4 000 000SEK and to IES not used as yet = 750 000SEK

N.B. The total budget in Tables 3.3-3.5 differs from the total in Table 3.1. This is due to the MSEK 2,260 for contingencies not being fully allocated yet.

There are a number of calls on the contingency budgets in Africa and Asia. Thus far the uses of contingency approved by Sida are 1.45 MSEK for Asia and 0.81 MSEK for Africa (see Table 3.1). There are further demands on contingency as a number of projects are reporting that they do not have enough funds to cover all anticipated activities and meetings in the project activities (see comments on funding in overview tables, Appendix 2). The contingency budget may not be large enough to cover all anticipated extra calls on funds. This should become clearer by the PMC meeting and can be discussed there.

Table 3.4 RAPIDC Phase III total expenditure up to 30 April 2006 for Asia

Total Asia budget					
Project number	Project		Total Budget	Accumulated expenditure	Balance
TOTAL			32,034,493	17,889,384	14,145,109
		Advance payment		3,500,000	
730,115	Male 1	Strengthen Regional Cooperation and stakeholder participation	4,269,076	2,257,796	2,011,280
730,215	Male 2	Strengthen monitoring stations	5,545,436	2,498,643	3,046,793
730,315	Male 3.1	Training and emission inventory preparation	1,630,400	758,732	871,668
730,325	Male 3.2	Emission scenarios	471,800	450,710	21,090
730,335	Male 3.3	Training in IAM	1,982,300	860,144	1,122,156
730,345	Male 3.4	Rapid urban assessment	1,793,048	624,679	1,168,370
730,415	Male 4.1	Health studies	1,829,800	938,344	891,456
730,425	Male 4.2	Crops	1,222,800	509,132	713,668
730,435	Male 4.3	Corrosion	766,848	372,759	394,089
730,445	Male 4.4	Acidification	405,680	4,866	400,814
730,515	Male 5	Prevention and control	2,296,100	434,061	1,862,039
730,615	Male 6	Awareness Raised	1,918,000	840,746	1,077,254
730,715	Male 7.1	RAPIDC man. and committees	1,078,020	717,250	360,770
730,725	Male 7.2	RAPIDC outreach	595,000	94,221	500,779
730,735	Male 7.3	RAPIDC adm and contracts	360,800	347,358	13,442
730,745	Male 7.4	RAPIDC reporting to Sida	801,600	241,125	560,475
732,005	Networks	CAD Male Side	1,589,317	901,736	687,581
732,105	Networks	APCEN Male side	892,726	478,762	413,964
732,205	Networks	CORNET Male side	1,078,342	900,138	178,204
732,305	Networks	APMA Male side	1,507,400	158,181	1,349,219

Table 3.5 RAPIDC Phase III total expenditure up to 30 April 2006 for Africa

Total Africa budget					
Project number	Project		Total Budget	Accumulated expenditure	Balance
TOTAL			12,697,387	8,126,408	4,570,979
		Advance payment		1,750,000	
731,115	APINA 1.1	National Stakeholder meetings	997,183	431,000	566,183
731,215	APINA 2.1	Expert meeting	776,117	629,801	146,316
731,225	APINA 2.2	Emission inventories	1,327,885	827,916	499,969
731,235	APINA 2.3	Monitoring	102,200	50,938	51,262
731,245	APINA 2.4	Modelling	355,126	77,421	277,705
731,255	APINA 2.5	Rapid urban assessment	1,118,359	252,250	866,109
731,265	APINA 2.6	Health studies	761,433	666,553	94,880
731,275	APINA 2.7	Crops	512,525	261,022	251,503
731,285	APINA 2.8	Ecosystems	37,800	12,312	25,488
731,295	APINA 2.9	Corrosion	379,480	237,487	141,993
731,315	APINA 3.1	Policy maker support	354,722	28,899	325,823
731,415	APINA 4.1	Publications and Outreach	336,720	57,277	279,443
731,515	APINA 5.1	Dev. of 3rd multi-stakeholder policy dialogue	885,082	30,967	854,115
731,525	APINA 5.2	Better Air Quality Africa	679,035	658,718	20,317
731,615	APINA 6.1	Coordination meetings	1,776,443	661,982	1,114,461
731,715	APINA 7.1	RAPIDC man. and committees	412,094	284,874	127,220
731,725	APINA 7.2	RAPIDC outreach	227,664	18,398	209,266
731,735	APINA 7.3	RAPIDC admin. And contracts	129,888	133,499	-3,611
731,745	APINA 7.4	RAPIDC Reporting to Sida	365,760	100,277	265,483
733,005	APCEN	APINA side	610,312	506,251	104,061
733,105	CORNET	APINA side	551,559	448,567	102,992

Appendix 1 Abbreviations

AAS	Atomic Absorption Spectrophotometer	
ABC	Atmospheric Brown Cloud	http://www-c4.ucsd.edu/ProjectABC/
ACE-Asia	Asian Pacific Regional Aerosol Characterisation Experiment	http://saga.pmel.noaa.gov/aceasia/
ACR	APINA Country Representative	
ADB	Asian Development Bank	http://www.adb.org/
ADORC	Acid Deposition and Oxidant Research Centre	http://www.adorc.gr.jp/adorc.html
AIDs	Acquired Immunity Deficiency	
AIT	Asian Institute of Technology	http://www.ait.ac.th/
AIT-EE	Environmental Engineering Laboratory, Asian Institute of Technology	
AMCEN	African Minister's Conference on Environment	
AMIS	Air Management Information System	http://www.who.int/peh/air/amis.html
AMMH	ASEAN Ministerial Meeting on Haze	http://www.aseansec.org
APCEN	Air Pollution and Crop Effects Network	
APINA	Air Pollution Information Network for Africa	http://www.york.ac.uk/inst/sei/rapidc2/apina/apina.html
APMA	Air Pollution in the Megacities of Asia	http://www.asiairnet.org/
AQM	Air Quality Management	
ASEAN	Association of Southeast Asian Nations	http://www.aseansec.org
BAQ	Better Air Quality	
BAQ-SSA	Better Air Quality in Sub-Saharan Africa	
BCAS	Bangladesh Centre for Advanced Studies	http://www.bcas.net/
BHU	Banaras Hindu University	
BR	Benchmarking Report	
CAAP	Composition and Acidity of Asian Precipitation	http://www.york.ac.uk/inst/sei/rapidc2/cad.html
CACGP	Commission on Atmospheric Chemistry and Global Pollution	
CAD	Composition of Asian Deposition	http://www.york.ac.uk/inst/sei/rapidc2/cad.html
CAI	Clean Air Initiative	http://www.cleanairnet.org/caiasia/1412/channel.html
CAI-SSA	Clean Air Initiative for Sub-Saharan Cities	
CAMx	Comprehensive Air quality Model with extensions	http://www.epa.gov/scram001/7thconf/information/camx.pdf
CAPIA	Cross Border Air Pollution Impact Assessment Project for SADC	http://dbn.csir.co.za/capia/
CEH	Centre for Ecology and Hydrology	
CES	Centre for Ecological Studies,	http://ces.iisc.ernet.in/

	India	
CETASD	Center for Environmental Technology and Sustainable Development, Hanoi	
CICERO	Centre for climate and environmental research, Oslo	
CIESM	Chongqing Institute of Environmental Science and Monitoring	
CGIAR	Consultative Group on International Agricultural Research	http://www.cgiar.org/
CNG	Compressed natural gas	
CO, CO_2	Carbon monoxide, carbon dioxide	
CORNET	Corrosion Network	
CPCB	Central Pollution Control Board, Delhi	
CSE	Centre for Science and Environment, India	http://www.cseindia.org/
CSIR	CSIR-South Africa	http://dbn.csir.co.za/
CSIRO	Commonwealth Scientific and Industrial Research Organisation, Australia	http://www.csiro.au/
CYMMIT	International Maize and Wheat Improvement Centre	
DA	Development Alternatives, India	http://www.devalt.org/
DACST	Department of Arts, Culture, Science and Technology, South African Government	
DEAT	Department of Environmental Affairs and Tourism, (South Africa)	
DEBITS	Deposition of Biogeochemically Active Trace Species	http://www.igac.noaa.gov/DEBITS.php
DHM	Department of Hydrology and Meteorology, Nepal	
DME	Department of Metallurgical Engineering, University of Zimbabwe	http://uzweb.uz.ac.zw/engineering/metallurgy/
DMMP	Department of Metallurgy and Mineral Processing, University of Zambia	http://www.unza.zm/metapages/metapage1.html
DoE	Department of Environment	
DPRK	Democratic People's Republic of Korea	
DWMPC	Department of Waste Management and Pollution Control, Botswana	
EANET	East Asia Acid Deposition Monitoring Network	http://www.adorc.gr.jp/
EAP-AP	Environmental Assessment Programme for Asia and the Pacific (now RRC-AP)	
EC	Elemental carbon	
EDGAR	The Emission Database for Global Atmospheric Research	http://arch.rivm.nl/env/int/coredata/edgar/index.html
EDU	Ethylene di-urea	
EHU	Environmental Health Unit (under the Ministry of Health)	
ELMS	Environment and Land	

	Management Sector	
EMEP	European Monitoring and Evaluation Programme (LRTAP)	http://www.unece.org/env/lrtap/
ENDA-TM	Environmental Development Action in the Third World	http://www.enda.sn/
ENGREF	Ecolé National du Genie Rural, des Eaux et des Fôrets, Paris University	http://www.engref.fr/
ENVIS	Environmental Information System, India	
EPD	Environment Protection Department, Hong Kong	http://www.info.gov.hk/epd/
EPTRI	Environmental Protection Training Research Institute, India	http://www.eptri.com/
EQMS	Environmental Quality Management System	
ERTC	Environmental Research and Training Center, Bangkok	
ESF	European Science Foundation	http://www.esf.org/
EU	European Union	http://europa.eu.int/
FANR	SADC Directorate of Food, Agriculture and Natural Resources	
FAO	Food and Agriculture Organisation	http://www.fao.org/
FP	Focal Point	
GAW	Global Atmospheric Watch	
GC	Governing Council	
GEIA	Global Emission Inventory Activity	http://weather.engin.umich.edu/geia/
GEO	Global Environment Outlook	
HIV	Human Immuno-deficiency Virus	
HQ	Headquarters	
HTTF	Haze Technical Task Force	
IAEA	International Atomic Energy Agency	
IAG	Informal Advisory Group	
IAM	Integrated Assessment Model	
ICCET	Imperial College Centre for Environment and Technology, London, UK	http://www.huxley.ic.ac.uk/ICCET/info.htm
ICIMOD	International Centre for Integrated Mountain Development, Nepal	http://www.south-asia.com/icimod/welcome.html
ICP	International Co-operative Programme (LRTAP)	
ICPEP	International Conference on Plants and Environmental Pollution	
IEA	International Energy Agency	
IES	Institute of Environmental Studies, University of Zimbabwe	http://www.ies.ac.zw/default.htm
IFPRI	International Food Policy Research Institute	
IGAC	International Global Atmospheric Chemistry Programme	http://www.igac.unh.edu/

IGBP	International Geosphere Biosphere Programme	http://www.igbp.kva.se/cgi-bin/php/frameset.php
IIASA	International Institute for Applied Systems Analysis	http://www.iiasa.ac.at/
IICT	Indian Institute of Chemical Technology	
IIED	International Institute for Environment and Development	http://www.iied.org/
IIED-AL	International Institute for Environment and Development-Latin America	
IIIEE	International Institute of Industrial Environmental Economics	
IITM	Indian Institute of Tropical Meteorology, Pune	http://www.tropmet.res.in/
IMPACTS	Integrated Monitoring Program on Acidification of Chinese Terrestrial Systems	http://www.impacts.net.cn/
IMS	Institute of Materials Science, Hanoi	
INDOEX	Indian Ocean Experiment	http://www-indoex.ucsd.edu/
INEC	Department of Infrastructure and Economic Co-operation (Sida)	www.sida.se
IRRI	International Rice Research Institute	http://www.irri.org/
ISAAC	International Study of Asthma and Allergies in Childhood	
ITM	Institute for Applied Environmental Research, Air Pollution Laboratory, Sweden	
IUAPPA	The International Union of Air Pollution Prevention and Environmental Protection Associations	http://www.iuappa.fsnet.co.uk/about.htm
IUCNP	The World Conservation Union in Pakistan	
IVL	Swedish Environmental Research Institute	http://www.ivl.se/en/
JICA	Japan International Cooperation Agency	
KCM	Konkola Copper Mines, Zambia	
KEI	Korea Environment Institute	http://www.kei.re.kr/eng/
KEVA	Kathmandu Electric Vehicle Alliance	http://www.keva.org.np/
KIMAB	Corrosion and Metals Research Institute	http://www.kimab.com/
LFA	Logical Framework Analysis	
LRTAP	Long-range Transboundary Air Pollution	http://www.unece.org/env/lrtap/
MATCH	Mesoscale Atmospheric Transport Chemistry Model	http://www.york.ac.uk/inst/sei/rapidc2/cad.html
MD	Malé Declaration	
MDTU	Meteorology Department of Tribhuvan University, Kathmandu, Nepal	
MEWT	Ministry of Environment, Wildlife and Tourism, Botswana	
MISU	Department of Meteorology,	http://www.misu.su.se/

	Stockholm University	
MMS	Malaysian Meteorological Service	http://www.kjc.gov.my/
MoC	Monitoring Committee	www.rrcap.unep.org/Malérepport
MoU	Memorandum of Understanding	
NAC	National Advisory Committee	
NBPGR	National Bureau of Plant Genetic Resources	
NEPAD	New Partnership for African Development	
NFP	National Focal Point	http://www.rrcap.unep.org/issues/air/Malédec/
NGO	Non-governmental Organisation	
NH_x	Reduced nitrogen emissions/deposition	
NIA	National Implementing Agency (for Malé Declaration)	http://www.rrcap.unep.org/issues/air/Malédec/
NIER	National Institute of Environmental Research, RoK	http://www.eco-web.com/cgi-local/sfc?a=index/index.html&b=register/02458.html
NIPH	National Institute of Public Health, Japan	
NIVA	Norwegian Institute of Water Research	
NML	National Metallurgical Laboratory, India	http://www.nmlindia.org/
NMVOC	Non methane volatile organic compounds	
NO_x	Nitrogen oxide and nitrogen dioxide emissions/deposition	
NO_y	All oxides of nitrogen emissions/depositions	
NPL	National Physical Laboratory in New Delhi, India	
NSCA	National Society for Clean Air, UK	http://www.nsca.org.uk/about.htm
O_3	Ozone	
OECD	Organisation for Economic Co-operation and Development	http://www.oecd.org/
PAG	Programme Advisory Group (RAPIDC)	
PAH	Polycyclic aromatic hydrocarbons	
Pak-EPA	Pakistan Environmental Protection Agencies	
PM	Particulate Matter: (e.g. PM_{10}, $PM_{2.5}$)	
PMC	Programme management Committee	
POPs	Persistent Organic Pollutants	
PSC	Programme Steering Committee (RAPIDC)	
QA/QC	Quality Assurance/ Quality Control	
RAINS Asia	Regional Air Pollution Information and Simulation Model	http://www.iiasa.ac.at/Research/TAP/rains_asia/docs/rains.asia.html
RAPIDC	Regional Air Pollution in Developing Countries	http://www.rapidc.org
REAP	Regional Environmental Action Plan, Central Asia	

RHAP	Regional Haze Action Plan	
RIVM	The National Institute for Public Health and the Environment in the Netherlands	
RoK	Republic of Korea	
RRC.AP	Regional Resource Center for Asia and the Pacific	http://www.rrcap.unep.org/issues/air/Malédec/
RRL	Regional Research Laboratory, Bhubaneswar	http://www.rrlbhu.res.in/
RUA	Rapid Urban Assessment	
S Asia	South Asia	
SA	South Africa	
SACEP	South Asia Co-operative Environment Programme	www.sacep.org
SADC	South African Development Community	http://www.sadc.int/
SAFARI	Southern African Regional Science Initiative	http://safari.gecp.virginia.edu/index.asp
SANTREN	Southern African Network for Training on the Environment	http://www.santren.com/live/santren/content/e572/index_eng.html
SARC	South Asian Regional Committee	
SAREC	South Asia Regional Energy Coalition	http://www.energysouthasia.com/
SC	Steering Committee	
SCI	Swedish Corrosion Institute	http://www.corr-institute.se
SE Asia	South-East Asia	
SEI	Stockholm Environment Institute	http://www.sei.se/
Sida	Swedish International Development Co-operation Agency	http://www.sida.se/
SLU	Sveriges Lantbruksuniversitet	http://www.slu.se/
SMHI	Swedish Meteorological and Hydrological Institute	http://www.smhi.se/
SO_2, SO_x	Sulphur dioxide, sulphur oxides	
SPRU	Science and Technology Policy Research Unit, University of Sussex??	
START	Global Change System for Analysis, Research and Training	http://www.start.org/
SUPARCO	The Pakistan Space and Upper Atmosphere Research Commission	
SUV	Sport utility vehicle	
TAC	Technical Advisory Committee	
TERI	TATA Energy Research Institute, India	http://www.teriin.org/
TISTR	Thailand Institute of Scientific and Technological Research	http://biodiversity.biotec.or.th/tncc/tistr_dete.html
ToR	Terms of Reference	
TSP	Total Suspended Particulate Matter	
TTL	Task Team Leader	
TTM	Task Team Member	

UAQM	Urban Air Quality Management	
UB	University of Botswana	
UDSM	University of Dar es Salaam	
UNCED	United Nations Conference on Environment and Development	
UNDP	United Nations Development Programme	http://www.unp.org/
UN DESA	United Nations Department of Economic and Social Affairs	http://www.uncosa.unvienna.org/directory/desa/
UN/ECE	United Nations Economic Commission for Europe	http://www.unece.org/
UNEP	United Nations Environment Programme	http://www.unep.org/
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific	http://www.unescap.org/
UNW	University of the North West	
UNZA	University of Zambia	
USAID	United States Agency for International development	
USEPA	United States Environment Protection Agency	
UZ	University of Zimbabwe	
VOC	Volatile Organic Compound	
WAERC	Water and Air Environmental Research Center	
WB	World Bank	http://www.worldbank.org/
WHO	World Health Organization	http://www.who.int/home-page/
WMO	World Meteorological Organisation	http://www.wmo.ch/indexflash.html
WSSD	World Summit on Sustainable Development	http://www.johannesburgsummit.org/
WWF	World Wildlife Fund	

Appendix 2 Overview tables of activities

Table A2.1 Overview Table of Malé Declaration Progress November 2006-April 2007

Activity (LFA number and short title)	Progress of workplan and use of funds	Recent meetings/events	Remaining tasks in relation to the LFA in RAPIDC Malé Declaration
LFA 1.1 Strengthen regional cooperation	- Activities are on schedule but the budget for the meetings, need to be revised	-The eighth intergovernmental meeting (Annual Network meeting 2006), and the third Session of the Regional Stakeholders cum Coordination Meeting were held in Thimphu, Bhutan (September 2006) - The draft publication on past, present and future of Malé Declaration (MD) was presented during the network meeting. - Malé Declaration brochure was published in August 2006 -Newsletter (vol.4-No1) and (vol4-NO_2) were published during April 2006 and Nov 2006	- Exchange programme during May 2007 - Newsletter (vol.5, No1) will be published during April 2007 -Publication on past, present and future of Malé Declaration -organize ninth intergovernmental meeting (Annual Network meeting 2007), the fourth Session of the Regional Stakeholders cum Coordination Meeting during September 2007)
LFA 1.2 Strengthen stakeholder participation	- Budget needed for hosting of fourth regional stakeholder meeting during September 2007	- the third Regional Stakeholder meeting was held in Bhutan (September 2006).	- the fourth Regional Stakeholder meeting will be held during September 2007 - Sri Lanka national stakeholder meeting will be held on 12 June 2007
LFA 1.3 Strengthen National Structure	- On schedule	- Bangladesh advisory group meeting (July 2006) was held at MOEF, Dhaka.	- Organize national advisory group meeting in each country.
LFA 2.1 Enhance Monitoring Capacity	- Countries agreed to contribute necessary manpower, space and the administrative support for the monitoring activities	- MoC agreed to country requests to have 3 new monitoring sites in Iran, Bhutan and Sri Lanka - Spare parts orders has been send out to the vendor for each monitoring site - Spare parts for wet only collector were provided to Sri Lanka, Nepal, Bhutan and Iran during the Refresher training programme in Bangkok, March 2007. - The data reports received from NIA's were updated before the Refresher training programme in March 2007 - Bangladesh, Bhutan, Sri Lanka, Nepal have signed the Phase III MoU and other countries are signing soon, although work is already ongoing. - The procedure on passive sampler inter-comparison was presented during the refresher training programme in March 2007. Pakistan, and Sri Lanka NIAs and NBRO, Sri Lanka will join the programme - AAS installation has been done in Bangladesh and Sri Lanka. - AAS for Nepal and Bhutan has been shipped and installation and training will be done	-Establish 3 news monitoring sites. - regular updating of regional database - Procurement of spare parts for each monitoring site - Update the MD manual - Conduct passive sampler intercomparison - Organize training for AAS in Nepal and Bhutan. - To strengthen monitoring activities in Bangladesh, in-country training on AAS and other equipment will be held during 7-8May 2007 - MoC (Martin Ferm) will visit Bangladesh for monitoring site audit during 7-8 May 2007 -Revised Malé Declaration manual

Activity (LFA number and short title)	Progress of workplan and use of funds	Recent meetings/events	Remaining tasks in relation to the LFA in RAPIDC Malé Declaration
		Pakistan competed establishment of monitoring site at Bahawalnagar, Pakistan during January 2007.	
LFA 2.2 Training in Monitoring	- On schedule and all fund will be used	- ToR of the Inter-laboratory comparison is being discussed with the AIT EE lab, which will act as reference laboratory. - The AIT EE lab participated as a reference laboratory during the refresher training programme which was held during March 2007 in Thailand.	- AIT EE laboratory will start functioning as a reference laboratory
LFA 2.3 Implementation of QA/QC programme	- On track	Draft protocol on inter laboratory comparison was presented during refresher training programme in March 2007	-finalise the protocol on inter laboratory comparison - Conduct the Inter-laboratory comparison
LFA 2.4 Study of the movement of air pollution	- on schedule	- Training on trajectory analysis together with Emission inventory compilation, scenario and IAM model was held during 3-8 July 2006 in and during 26 February to 2 March, 2007, both in Bangkok, Thailand.	- Discussion and preparation of contract with consultant on preparation of pollution movement analysis
3.1 Develop capacity in emission inventory preparation	- Some of the smaller countries (e.g. Sri Lanka, Bhutan and Nepal) may require extra resources to compile the emissions inventory but it is anticipated that this will be found from within the existing budget.	- The first Training workshop on emission inventory preparation / scenarios / atmospheric transport modelling workshop was held during 3-8 July 2006 and the second training during 26 February to 2 March 2007 in Bangkok, Thailand. -Established an email discussion forum after the first emission training workshop	- The manual needs to be revised and updated, with new pollutants added, improved emission factors and other improvements
3.2 Develop capacity in emission scenario development	- on schedule	- The first Scenario sessions by IIIEE was given during the Training workshop on emission inventory preparation / scenarios / atmospheric transport modelling workshop held during 3-8 July 2006 in Bangkok, Thailand and the second on 26 February to 2 March 2007 in Thailand -draft policy case study manual and draft development of emission scenario background and procedure manual were presented during these trainings.	- IIIEE to oversee development of work in this area
3.3 Develop regional integrated assessment capability	- on schedule	Lectures have been given at the workshops at UNEP RRC/AP in Bangkok in July 2006 and February 2007. The MATCH model has been installed at UNEP RRC/AP during November-December 2006. A generic training of dispersion modelling was given to the NIAs at the workshop in July 2007. A description of MATCH, in particular, and a demonstration of its usage was given to the NIAs at the second workshop in February 2007 Ozone results presented a the two RAPIDC workshops (APCEN (in Stellenbosch September 2006) and CAD (in Hyderabad Nov-Dec, 2006))	- Try to start the PM modelling
3.4 Develop urban rapid integrated assessment	- on track	- A workplan has been prepared. - Kathmandu, Nepal has been chosen as	-The first mapping campaign will start in Kathmandu April-May 2007.

Activity (LFA number and short title)	Progress of workplan and use of funds	Recent meetings/events	Remaining tasks in relation to the LFA in RAPIDC Malé Declaration
capability		the case city for the RUA study. A manual for emission inventory has been sent to the NIA, and their initial survey is on-going. - At the meeting in Thimphu a preliminary plan for the air quality monitoring programme was discussed, taking into account on-going monitoring activities in Kathmandu. - All the material required for the first mission to Kathmandu, on training in RUA, has been prepared. -Training on RUA took place at ICIMOD in Kathmandu, Nepal in late November 2006 - A revised manual was delivered to ICIMOD after the training on RUA in November 2006.	
4.1 Strengthen knowledge on impacts of air pollution on Human health	- on track	-MoU has been signed with Bangladesh NIA on health impact study. - Survey on health impact study and training for school teacher/technicians were already started according to work plan in Bangladesh. -Expert from Murdoch University visited Dhaka during January 2007 for health survey. - Pakistan expressed their interest to participate in health impact study during meeting in Thimphu Bhutan in Sept 2006. - the first training workshop on Health Impacts was held in Bangkok during 19 to 22 February 2007	- Work plan and MoU for Pakistan - the second training workshop on Health Impacts is planned to be held in Bangkok during October 2007
4.2. Strengthen knowledge on impacts of air pollution on crops	- behind schedule as problems obtaining import permits for plant material in biomonitoring study	- Almost all the NIAs have participated in training workshop and also sent the selected appropriate institution for the Bio monitoring programme. - Bangladesh, Bhutan, India, Nepal and Pakistan are agreed to join the Bio monitoring programme. - Bio-monitoring campaign: currently the Pakistan site will act as the pilot for this study for the Malé region. -The chemical protectant study was piloted in 2006 in Varanasi, India. The result show that the ozone concentrations are high. - Sri Lanka site will carry out the experiment of EDU. - Bangladesh has started the biomonitoring experiment - A provisional risk assessment has been performed for South Asia using the MATCH model.	- A regional training on crop impact assessment will be held in Dhaka in mid August 2007 - The site in Pakistan would ideally take on the role of a regional technical support centre for the clover-clone bio-monitoring study. - the site in Sri Lanka would ideally perform the EDU experiment and also manufacture EDU for provision to other south Asia countries.
4.3. Strengthen knowledge on impacts of air pollution on corrosion	- More budget is needed for hosting workshops and two new sites.	- Organized workshop and training: CORNET/Training workshop on sample evaluation, October 9-11, Bangkok, Thailand. The AIT EE lab participated as a reference laboratory during the workshop. - First meeting of the CORNET task force was held during October 2006 workshop. - Initial discussion/ consultation with NIAs on site selection (Nepal, Iran, India and Maldives) to expose the sample rack were	- organize second training workshop in the beginning of 2008 on evaluation and interpretation of results. - withdrawal and analysis of corrosion attack on the four test sites - two new test sites in Bangladesh and Maldives if funds available - withdrawal and analysis of corrosion attack for the ten kits exposed in Kathmandu

Activity (LFA number and short title)	Progress of workplan and use of funds	Recent meetings/events	Remaining tasks in relation to the LFA in RAPIDC Malé Declaration
		made during training period. - Completed installation of sampler racks at India, Sri Lanka, Iran and Nepal sites. Maldives for site selection. -Input below from Corrosion and Metals Research Institute (KIMAB): 4.3.2 Demonstrate corrosion risks: Confirmation of new partner in co-operation with SEI and IVL: Nepal. Preliminary choice of test sites -Ten corrosion kits were erected in Nepal site in the fall of 2006 with planned withdrawal of specimens in the fall of 2007.	
4.4. Strengthen knowledge on impacts of air pollution on acidification	- On track	Preliminary consultations have been held with NIAs on acidification assessment work	Workshop will be held in early 2008
5.1 Provide decision support information for policy formulation and mitigation	- delays but on track	- Preliminary draft status on Policy Options for Air Pollution Prevention and Control in South Asia has been developed by IIIEE for Bangkok workshop during 5-6 July 2006. More advanced draft documents on policy case study manual and development of emission scenario background and procedure manual were distributed to participants during the second training on 26th Feb to 2nd March 2007.	MoU with Prof.Ram Shrestha, AIT, needs to be signed for preparing a compendium of best practices and developing strategies to promote them Execute the above mentioned MoU
5.2 Case studies of practical options to prevent air pollution	- delays but on track	- Bangladesh NIA agreed to participate in Eco-housing activities. - Two members of the Maldives design team visited the Regional Expert Group members in Bangkok during 10-12 September 2006. The aim was to get guidance regarding the preliminary design of the eco-building in Hanimaadhoo island. - A design review workshop was held in Thimphu, Bhutan, on 14th September 2006, regarding the eco-building being designed in Thimphu. - Article on Eco-housing was published in Malé Newsletter (Vol4. No.1)	- Develop proposal for Bangladesh NIA's participation in Eco-Housing - Identification of Institution for Bangladesh to participate in Eco-Housing
5.3 Sector based approaches to pollution prevention and control	- delays but on track	- Linked to work in 5.1 and 5.2	- link to emissions manual and IIAS
6.1 Raise awareness for action through targeted dissemination	- on track	- A concept paper on "Regional Initiative on Environment and Health in South Asia" was presented to the Third Regional Stakeholders cum Coordination in Bhutan on September 2006. -Established link with South Asia Youth Environment Network (SAYEN). - Representative from SAYEN is participated the stakeholders meeting as the first time in September 2006. - MoU has been signed with SAYEN Secretariat on "Youth for Clean Air: A sub-regional project" which is proposed as part	- conduct the inception workshop for the Youth for Clean Air in May 2007 - publication of the past, present and future of Malé Declaration

Activity (LFA number and short title)	Progress of workplan and use of funds	Recent meetings/events	Remaining tasks in relation to the LFA in RAPIDC Malé Declaration
		of the Raising Awareness among Youth for Action, Malé Declaration. - distributed brochure on Malé Declaration during Sept meeting. - distributed brochure and leaflets on Malé Declaration during the BAQ 2006 workshop at Yogyakarta, Indonesia in December 2006	

Table A2.2 Overview Table of APINA Progress November 2006-April 2007

Activity (LFA number and short title)	Progress of workplan and use of funds	Recent meetings/events	Remaining tasks in relation to the LFA in RAPIDC APINA proposal for April 2006 to April 2007 activities
1.1 Strengthen stakeholder participation and national APINA structures	- On Schedule - only one country still to finalize first stakeholder report (Malawi)	- Some countries have been having meetings of TTMs and TTLs to share progress and enhance linkages. - NFPs and ACRs have been linking with the coordination team and TTLs to facilitate activities of the programme	-Updating Country Air Pollution Status Reports
2.1 Ensure synergies amongst APINA Task Teams and with other regional and international initiatives	-Completed in first year	Workshop proceedings produced and disseminated through e-mail and as hard copies at the APINA annual meeting in September 2006	-Completed
2.2 Develop capacity in emission inventory preparation	- Sight delay	-All TTMs for the emissions inventory task team attended the modelling workshop in Durban in February 2007. -Manual has been updated to take account of point sources. -TTMs still collecting data on point sources -Mr Joseph Kanyanga TTM for Zambia attended Decision Support Workshop held in Dar es Salaam, April 2007 on behalf of TTL.	-Completion of National Emissions Inventories in the APINA participating countries which was expected by 30 April 2007
2.3 Establish/ Enhance monitoring network in participating countries	- On track	- A scoping report on existing monitoring activities in the region has been compiled by Task Team Leader, Mr. Moabi Mmolawa with contributions from TTMs -TTL attended the Decision Support Workshop held in Dar es Salaam in April 2007	-Incorporation of corrections/comments from APINA Secretariat by TTL
2.4 Enhancing atmospheric transfer modelling and integrated assessment activities in southern Africa	- On track	- Task Team Leader, Dr. Mark Zunckel has compiled a scoping report on existing activities on atmospheric transfer modelling and integrated assessment activities in Southern Africa with inputs from the TTMs - A 5-day dispersion modelling course was hosted by the TTL in Durban, South Africa, in February 2007, with the TTMs for modelling and emissions inventory from each of the 7 APINA countries participating. Dr Mark Zunckel and Atham Raghunandan facilitated the workshop. - Mr Barnabus Chipindu TTM for Modelling for Zimbabwe attended the Decision Support Workshop held in Dar es Salaam in April 2007 on behalf of TTL.	-None
2.5 Develop Rapid Urban Air Quality Assessment capability	- Slight delay. Potential for training on Strategic Framework development for AQM for Maputo	- Maputo has been selected as suitable city for the RUA activity -Implementation of the RUA started on 15 February 2007. -Three local training workshops have been carried out on the different aspects of RUA	-Holding of Training Workshop in June/July 2007. -The monitoring is on-going.

Activity (LFA number and short title)	Progress of workplan and use of funds	Recent meetings/events	Remaining tasks in relation to the LFA in RAPIDC APINA proposal for April 2006 to April 2007 activities
	stakeholders by SEI if contingency available.	with facilitation by IVL. -Samplers have been put out in Maputo and nearby City of Matola. -Mr Juliao Cumbane and Mr Paipe attended the Decision Support Workshop held in Dar e s Salaam in April 2007.	
2.6 Strengthen knowledge on impacts of air pollution on human health	- Slight delay	-Mrs Tariro Chingono TTL for task team attended the Decision Support Workshop held in Dar es Salaam in April 2007	- Seek funding for country priority projects -Production of a health impact assessment report synthesizing the results provided by participating countries.
2.7 Strengthen knowledge on impacts of air pollution on crops	- Delayed	- an attempt was made to establish five biomonitoring sites in Botswana, Zimbabwe, Zambia, Mozambique and Tanzania in addition to the pilot site in South Africa. -Problems in establishing live clover-clones at the bio-monitoring sites were encountered. The long transport times and harsh conditions the plants experienced during transport weakened the plants making them unable to acclimatise once they arrived at the locations.	- A second attempt will be made to set up the clover bio-monitoring experiment at the 5 sites using plant material grown up in South Africa.
2.8 Strengthen knowledge on impacts of air pollution on natural ecosystems	- On track	-A scoping report incorporating a proposal for Phase IV activities has been drafted. -The TTL Mrs Meya Kalindekafe attended the Decision Support Workshop held in Dar-es-Salaam in April 2007	- Finalising of scoping report.
2.9 Strengthen knowledge on impacts of air pollution on corrosion	- Slight delay	-The APINA Corrosion Task Team held a workshop during February 2007 in Kitwe, Zambia. The Kitwe workshop had participants from all the corrosion experiment sites in South Africa, Tanzania, Mozambique, Zambia and Zimbabwe. One year trend results for the period ending August/September 2006 for the original APINA sites in South Africa, Zambia and Zimbabwe were evaluated. -The TTL attended the Decision Support Workshop held in Dar es Salaam in April 2007. .	- Feasibility study report on possibility of carrying out corrosion assessment using Rapid Corrosion Assessment kits in the region. -Feasibility study report on conducting stock at risk and economic assessment of corrosion damage in the region.
3.1 Provide decision support information for policy formulation and mitigation	- Slight delay	- The 3 TTLs for legislation and policies; control/mitigation and socio-economic issues attended Decision Support Workshop held in Dar-es-Salaam in April 2007. -The TTL for control and mitigation has compiled a scoping report on control and mitigation of air pollution in southern Africa	- Scoping study on policies and legislation on air pollution issues in Southern Africa - Scoping study on socio-economic issues related to air pollution and the cost benefit analysis of mitigating air pollution in Southern Africa
4.1 Raise awareness for action through	- Slight delay	- Design of APINA website - Three newsletters on Phase III activities will be posted on the APINA website by	-Launch APINA website - -Post three newsletters on Phase III

Activity (LFA number and short title)	Progress of workplan and use of funds	Recent meetings/events	Remaining tasks in relation to the LFA in RAPIDC APINA proposal for April 2006 to April 2007 activities
targeted dissemination		end of May 2007 -Proceedings of all the workshops carried out so far will be posted on the APINA website by end of May 2007. -Completed scoping reports will be posted on the APINA website by end of May 2007.	activities will be posted on the APINA website by end of May 2007 -Proceedings of all the workshops carried out so far will be posted on the APINA website by end of May 2007. -Completed scoping reports will be posted on the APINA website by end of May 2007.
5.1 Develop a Regional Policy Process for Air Pollution in (Southern) Africa	- Slight delay	- Sara Feresu visited UNEP several times while on other missions and discussed issues related to APINA and BAQ and its follow up activities. -Sara Feresu participated in the GAP Forum Meeting in Gothenburg in March 2007. -She also accompanied Kevin Hicks on his first mission to UNEP to discuss GAP Forum activities in April 2007	- First visit to SADC Gaborone that is scheduled for first week of June 2007.
5.2 Promote Better Air Quality Management in the cities of Africa	On schedule	-Discussion have continued with UNEP World Bank and USEPA on follow up activities on BAQ-SSA 2006. A tele-conference was held in November 2006. - Sara Feresu and Kevin Hicks discussed these issues during their visit to UNEP in April 2007	Continue discussions with collaborating partners on organisation of BAQ 2006 follow-up activities on the possibility of hosting a regional consultative meeting on sulphur reduction in fuels.
6.1 Enhancing networking and co-ordination	On going	-The Coordination Team interacted well with TTLs, TTMs, NFPs and ACRs in the programme and networking has been enhanced through these interactions. -Most of the subcontracts are on schedule -The Coordination Team has facilitated the organization of various workshops in the network such as the Corrosion Workshop in Kitwe, Zambia. (February 2007), Modelling Workshop in Durban, South Africa (February 2007) and Decision Support in Dar es Salaam, Tanzania (April 2007). -The Coordination team has participated in PMC teleconferences	-None

Table A2.3 Overview Table of RAPIDC Network Progress November 2006-April 2007

Activity (LFA number and short title)	Progress of workplan and use of funds	Recent meetings/events	Remaining tasks in relation to the LFA in RAPIDC Networks proposal
Composition of Asia Deposition (CAD)			
1.1 CAD Network Development	On schedule	CAD Workshop in Hyderabad, India, December 2006. Attended by the facilitator of the Male Declaration Mr Rajamani	
2.1 Training scientists from Asia			Workshop will take place in 2007
2.2 Capacity building through development of high quality sites		On going measurements at CAD sites in India (Delhi, Pune, Bhubaneswar)	
Air Pollution Crop Effects Network (APCEN)			
1.1Maintain and expand APCEN network	On schedule except some problems with obtaining plant import permits in India for pilot study for APCEN.	Presentation of the project at scientific meetings mostly using funds outside of RAPIDC (IGAC, Cape Town, South Africa, September, 2006; BAQ, Yogjakarta, Indonesia, December 2006; ABC, Bangkok, Thailand, December 2006; UNECE CLRATP ICP Vegetation, Dubna, Russia, March 2007).	The focus will be on consolidation of APCEN outreach materials (e.g. finalisation of the APCEN website), finalisation of the APCEN organisational structure (e.g. steering committee) and preparation for the 3rd APCEN workshop scheduled for early 2008 (second this phase) which will include development of policy statements, venue likely to be Delhi, India. This workshop will focus on developing appropriate socio-economic assessment methods.
1.2 Development of APCEN network role			
2.1 Enhancing capacity of scientists to undertake experiments		Site visits by Patrick Büker of SEI to Nepal, Sri Lanka and Bangladesh to help establish biomonitoring sites in Male Declaration countries.	
3.1 develop socio- economic assessments		-	
The Corrosion network (CORNET)			
1.1 Corrosion Network (CORNET) development and capacity building	On schedule with a request of an additional workshop in the beginning of 2008 on evaluation and interpretation of results.	CORNET meeting and training held in Bangkok October 2006	Hold workshop and training on evaluation and interpretation of results beginning 2008 (if funds available)
1.2 Continuation of Exposure Network sites from 2001-2004	On schedule	In country evaluation of results following on from training received in October 2006.	Collection of relevant data for evaluation of dose-response functions. Establishment of trends in corrosion and pollution and comparison of samples evaluated in individual countries to those evaluated in KIMAB
The Air Pollution in the Mega cities of Asia (APMA)			

Activity (LFA number and short title)	Progress of workplan and use of funds	Recent meetings/events	Remaining tasks in relation to the LFA in RAPIDC Networks proposal
Network			
1.1 Support AQM strategy formation in selected Asian cities	On schedule and budget reorganised to allow purchase of monitoring equipment and travel to enhance development of AQM strategies in South Asia in connection with the Malé Declaration	In the second year of the programme the cities of Kathmandu and Karachi were selected. Discussion has been undertaken with key stakeholders in each city. Dr Dieter Schwela visited ICIMOD and ENPHO in Kathmandu to finalise the work plan for this activity. Discussion has been undertaken with IUCN Pakistan and the Pakistani Environmental Protection Agency to finalise the work plan for Karachi.	The activities in both cities will be undertaken in June and July 2007.
1.2 Development of a AQM information system (AMIS-Asia) for Asian cities	Slightly behind schedule	The benchmarking study has provided the foundation for this activity. Work has started on examining how this information can provide an accessible web-based database.	Development of accessible web-based database.

Appendix 3. Reports for the Malé Declaration Activities

LFA 1.1 Strengthen regional cooperation

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 1.1 Strengthen regional cooperation	**Project Number:** 730 115
Lead institution: UNEP RRC.AP	**Prepared by:** UNEP RRC.AP
Collaborating Institutions: (name; principal contact; contact details) NIAs; FPs (Contact with UNEP RRC.AP) (see Annex 2 for details); SACEP (Contract with UNEP RRC.AP) SEI Other technical advisors (e.g. ; IVL, SMHI, IIIEE -as part of their contracts with SEI)	

Assessment and analysis of progress:

1. Outline of original project

Outline of the original project: The objective of this project is to enhance the Malé Declaration network through strengthening regional cooperation. To achieve this at the national level, NIAs will incorporate more national experts and institutions into the process and at the sub-regional level, more collaboration will be undertaken with other related activities in South Asia. The network will be developed through continued intergovernmental meetings, exchange of experience among NIAs and FPs and coordination between national and regional programmes in the region by broadening participation in the Malé Declaration.

2. Describe any deviation from original plan(s) and budget (with reference to current financial statement)

There is no deviation from original plans on activities under this project but an increase in the budget is required to complete the activities scheduled. The potential for this additional funding to be covered by the Malé contingency is being investigated.

3. Results, outcomes and deliverables

One major activity is the holding of annual meetings of the governments which provide the opportunity for them to discuss and strengthen regional cooperation among the participating countries. The eighth session of the intergovernmental (IG8) meeting was held in Thimpu, Bhutan on 13th September 2006. His Excellency, Mr. Dasho Nado Rinchhen, Deputy Minister, National Environment Commission (NEC) of Bhutan chaired the session. This is the first time a Minister has chaired the intergovernmental meeting of the Declaration. This is in line with the request of IG7 for higher level participation from the national focal points. This year's intergovernmental meeting was also attended by Afghanistan as observer.

The Secretariat, through the regional facilitator, has conducted an evaluation of the existing institutional structure at the request of the IG6. In the light of this review, IG considered it advisable to recast the overall institutional arrangement, under the guidance of the National members, to bring in other key players as well as those who may have to be inducted for the next phases of the Malé process. Based on the recommendations of this evaluation, IG8 has adopted an extended institutional structure for the Male' Declaration (Fig 1.1). This is a major result towards strengthening the institutional structure.

As part of the evaluation process, the governments and stakeholders were also consulted, via a questionnaire, on the possibility of devising a Protocol for the Malé Declaration. Based on the results of this consultation, the IG8 has decided that the discussions can be initiated after data flow from the monitoring stations has been checked and analysed.

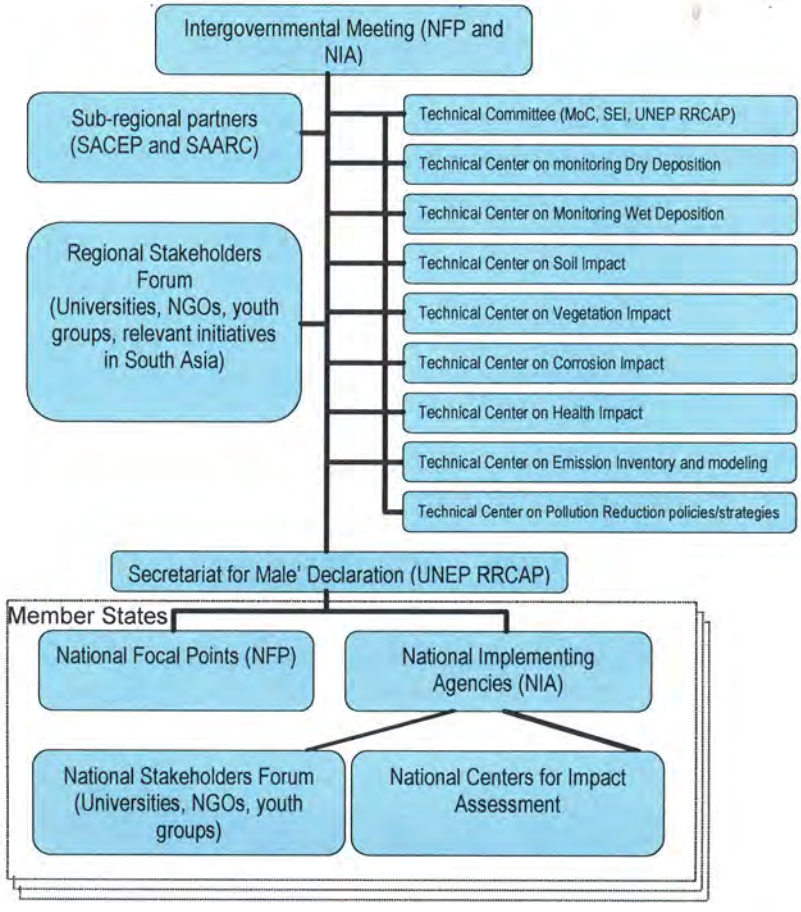

Figure 1.1 The proposed new institutional structure of the Malé Declaration

During the reporting period, National Focal Points have identified expert institutions to participate in the impact assessment studies. This has resulted in the expansion of the Malé Declaration network into the impact assessment area.

As one of the activities to promote networking among the member countries, the Secretariat published the Malé Declaration newsletter, Vol 4 Number 2 in November 2006. It is expected that the newsletter

will serve as a medium for information sharing both within and beyond the Malé Declaration network. The digital file is available to be downloaded from http://www.rrcap.unep.org/ew/air/male/newsletter.cfm.

4. Assessment and analysis of progress:

The long-term objective of the Malé Declaration is to control/prevent the impact of transboundary air pollution by providing meaningful information to policy makers and promoting the policy cycle in South Asia. Promotion of the policy cycle so far has been very successful through these activities.

The activities during the reporting period have enhanced the intergovernmental network moving it closer towards achieving its objectives. Implementation of the institutional structure will result in increasing ownership. Some the indicators of network enhancements include:

- Adoption of the new institutional structure, which includes specialised technical centres and the South Asian Association for Regional Cooperation (SAARC).
- With the identification of national institutions for conducting impact assessment studies, the Malé Declaration network has been extended. Previously, the network included only the intergovernmental network, monitoring network, and stakeholders network.
- Afghanistan has joint the intergovernmental process as observer.
- The IG8 reviewed and decided to support the activities of the Global Atmospheric Pollution Forum.

Further advancement in the policy cycle will mainly depend on building the capacity of national institutions and the implementation of the new institutional structure adopted by IG8.

5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

This programme is increasingly linked with all other RAPIDC activities. During the Third Regional Stakeholders cum Coordination meeting, SEI presented a brief outline of the RAPIDC programme in Asia, African and South America and its support for Malé Declaration. The proposed initiatives of the Global Atmospheric Pollution Forum were also presented to get the views, concerns and support of the stakeholders. Also, all the projects in Malé and their linkages to the different technical advisors were briefly outlined to the NIAs by SEI.

Malé Declaration, East Asia Network on Acid Depositions (EANET), and ASEAN Haze agreements are the major intergovernmental agreements on transboundary air pollution in Asia. Malé Declaration implementation is strongly linked with the other intergovernmental agreements, since UNEP host the secretariat for EANET, and participated in the development of the ASEAN haze agreement. UNEP also hosts the secretariat for the Atmospheric Brown Cloud (ABC) project.

The third Regional Stakeholder cum Coordination meeting which was held in Bhutan during 12-13 September 2006 under Malé Declaration was attended by EANET, IUAPPA, CIA-Asia, ABC and the Regional Research Network for improving Air Quality in Asian Developing Countries programme. The other programme initiatives on air pollution in South Asia also participated in the meeting. The

Secretariat presented updates on the implementation of the Malé Declaration at the major air quality related events such as BAQ 2006 and Saltsiobaden III.

6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

One of the major activities for further strengthening the Malé Declaration intergovernmental network is the implementation of the new institutional structure. This will be initiated though establishment of intergovernmental working groups on each of the new areas identified in the new institutional structure. This will be included as a major activity during the Phase IV implementation of the Malé Declaration.

The proposal for the Phase IV will be developed through extensive consultation with the governments. This will be conducted through an Exchange Programme between the national level Project Managers and the Secretariat at UNEP RRC.AP, to be held 22nd to 31st May 2007 at the UNEP RRC.AP office, Thailand.

The ninth Intergovernmental meeting (IG9) will be organized for September 2007 to guide the implementation process. In order to strengthen the intergovernmental process, the IG9 is expected to deliver the following:

- Review of the progress science IG8
- Agree on a work plan for the year 2008
- Launching of a publication on the Malé Declaration (past, present and future), which will document the institutional mechanism of the Malé Declaration. This will provide a formal reference work on the Malé Declaration.

Issues related to the handover of ownership: The Malé Declaration has been owned by the governments from its inception in 1998. The Malé Declaration was drafted by the policy makers and experts from South Asia during a policy dialogue meeting. During the reporting period, an extended institutional structure for the Malé Declaration was adopted aimed at strengthening the ownership. The Governments have unanimously decided that UNEP should continue as the Secretariat and UNEP has already taken some of the reporting responsibilities from SEI. It is planned to develop the Phase IV proposal in extensive consultation with the governments at all levels; namely, expert level, project managerial level, and intergovernmental level. The proposal, which will be compiled the Secretariat, will define the role of relevant stakeholders and inter governmental networks (SACEP and SAARC) in the implementation of the Phase IV activities.

LFA 1.2 Strengthen Stakeholder participation

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 1.2 Strengthen Stakeholder participation	**Project Number:** 730 115
Lead institution: UNEP RRC.AP	**Prepared by:** UNEP RRC.AP
Collaborating Institutions: (name; principal contact; contact details) NIAs; FPs; SEI; IVL; SMHI; Other technical advisors (Contracts as 1.1)	

Assessment and analysis of progress:

1. Outline of original project

1.1: Outline of the original project: The objective of this project is to enhance the Malé Declaration network through strengthening regional and national stakeholder participation to support the Malé Declaration. To achieve the objective at the national level, NIAs will incorporate more national experts and institutions into the process and at sub-regional level more collaboration will be effected with other related activities in South Asia. The network will be developed through continued stakeholder involvement and by broadening their participation in the Malé Declaration at the national and regional level.

2. Describe any deviation from original plan(s) and budget (with reference to current financial statement)

There is no deviation from original plans on activities under these projects.

3. Results, outcomes and deliverables

Malé Declaration is one of the few intergovernmental networks to have a formal network for stakeholder consultation. The consultation is being facilitated through annual meetings. The Third Regional Stakeholders cum Coordination meeting and eighth intergovernmental meeting of Malé Declaration was held in Thimpu, Bhutan during 12 – 13 September 2006. The meeting was attended by the National Focal Points (NFP) and National Implementing Agencies (NIA) of Malé Declaration as well as representatives from various stakeholders groups and ongoing initiatives on air pollution at national, sub-regional, regional, and global levels. His Excellency Mr. Dasho Nado Rinchhen, Deputy Minister, National Environment Commission (NEC) of Bhutan chaired the meeting. His Excellency, Lyonpo Yeshey Zimba, the Minister for Trade and Industry, Bhutan was the Chief Guest at the opening section of the meeting. H.E pointed that there is a gradual increase in air problems in Bhutan such as vehicular emission and local dust reducing visibility, and emphasized the effects of transboundary transport of air pollutants. As air pollution is one of the major environmental challenges in the region, H.E stressed the need for concerted regional cooperation to address this regional problem. H.E appreciated the support and cooperation of various institutes, and thanked everyone including the organizers of the meeting.

Progress in the implementation of the Malé Declaration during 2006 and the proposed work plan for 2007 were presented and reviewed by the stakeholders. In addition to the review of activities under the Malé Declaration, the stakeholders' forum has also provided a forum for the air quality related initiatives in South Asia to share their experiences.

As requested by the previous stakeholders' forum, additional stakeholder groups are being added to the forum. For example, the eighth intergovernmental meeting was attended South Asia Youth Environment Network as the first time.

The forum also attracted relevant intergovernmental networks such as EANET, and urban air quality networks such as CAI-Asia. By and large, the participation of a wide range of stakeholders and their contribution are encouraging. It is expected that this forum will emerge into a major air pollution related event in South Asia.

4. Assessment and analysis of progress:

The long-term objective of Malé Declaration is to control/prevent the impact of transboundary air pollution by providing meaningful information to the policy makers and promoting the policy cycle in South Asia. Promotion of the policy cycle so far has been very successful through these activities. Some of the indicators of success include:

- Expert institutions to conduct the assessment studies of Malé Declaration activities at the national level have been identified through stakeholder consultation.
- Increase awareness due to articles published by NGOs who attended the Stakeholders forum
- Technical inputs for the 2007 work plan
- Dissemination of Malé Declaration related information for youths through the SAYEN representative who participated at the stakeholders meeting.

The implementation of the institutional arrangement adopted by the 8th Session of the intergovernmental meeting will further increase the involvement of stakeholders both at national and regional level. There is a need to include additional stakeholders groups such as industries. This will be considered during the next phase.

5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

This programme is increasingly linked with all other RAPIDC activities. During the Third Regional Stakeholders cum Coordination meeting, SEI presented a brief outline of the RAPIDC programme in Asia, African and South America and its support for Malé Declaration. Information about the Global Atmospheric Pollution Forum was also presented in order to make the most of the opportunities for consultation with the NIAs and stakeholders for their view, concern and support. Also, all of the projects in Malé and linkages to different technical advisors were briefly outlined to the NIAs by SEI.

Malé Declaration, East Asia Network on Acid Depositions (EANET), and ASEAN Haze agreements are the major intergovernmental agreements on transboundary air pollution in Asia. Malé Declaration implementation is strongly linked with the other three intergovernmental agreements, since UNEP host the secretariat for EANET, and participated in the development of ASEAN haze agreement. UNEP also hosts the secretariat for the Atmospheric Brown Cloud (ABC) project.

The third Regional Stakeholder cum Coordination meeting which was held in Bhutan from 12th -13th September 2006 under Malé Declaration and was attended by EANET, IUAPPA, CIA-Asia, ABC and Regional Research Network for improving Air Quality in Asian Developing Countries programme. The other programme initiatives on air pollution in South Asia were also represented at the meeting.

6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

There is a need to study the expansion of the stakeholders networks to include representatives from Industries. This will be implemented during the Phase IV implementation. There are many air pollution related initiatives in South Asia implemented by the World Bank. The World Bank has not participated in any of the previous stakeholders meeting. Attempt will be made to identify appropriate participants from the World Bank.

The fourth regional stakeholder cum coordination meeting will be organised together with the ninth Intergovernmental meeting in September 2007. The meeting will provide the opportunity for the Malé Declaration to review its progress in 2007 and proposed work plan for 2008 activities. Also, the fourth regional stakeholders cum coordination meeting is an opportunity for the stakeholders to review the proposal for the Phase IV implementation of the Malé Declaration

Issues related to the handover of ownership: Participants from the stakeholders meeting are being identified as implementing partners for some of the activities of the Malé Declaration. For example, the South Asia Youth Network (SAYEN) is participating in the development and dissemination of public awareness activities. This has enhanced the ownership during the reporting period.

8. Any other relevant comments/grievances etc

None

LFA 1.3 Strengthen national structures

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 1.3 Strengthen national structures	**Project Number:** 730 115
Lead institution: UNEP RRC.AP	**Prepared by:** UNEP RRC.AP
Collaborating Institutions: (name; principal contact; contact details) NIAs, FPs, Contract as in 1.1	

Assessment and analysis of progress:

1. Outline of original project

1.1: Outline of the original project: To enhance the Malé Declaration network through; strengthening national structures to support the Malé Declaration. To achieve the objective, at the national level NIAs will incorporate more national experts and institutions and by organising the National Advisory Committee.

2. Describe any deviation from original plan(s) and budget (with reference to current financial statement)

There is no deviation from original plans

3. Results, outcomes and deliverables

National Advisory groups have been established in all the participating countries. During the eighth session of the inter-governmental meeting held in Bhutan, NIAs presented the membership and activities of the national advisory group. National advisory groups meet regularly to review the national implementation process, especially the improvement of data quality. For example, a meeting of the National Advisory Committee for Bangladesh was held on 2nd July 2006 under the Chairmanship of Mr. Tariq-ul-Islam, Joint Secretary, Ministry of Environment and Forests (MOEF) at the MOEF, Dhaka, Bangladesh. The meeting reviewed the existing monitoring activities and discussed the implementation of impact assessment studies during Phase III.

National advisory groups are expected to meet monthly. The IG8 decided that it may not be feasible for the National Advisory Committee to meet monthly for data verification. IG recommended that a small group of technically competent personnel from the national advisory committee should be established to verify the data before submitting to the Secretariat.

4. Assessment and analysis of progress:

National implementing Agencies (NIAs) are fully responsible for the establishment and implementation of activities of national level stakeholders. Currently the activities are mainly focused on the establishment of a proper structure for the national level consultation. Following are some of the indicators of success:

- National advisory groups have been established in all the participating countries. This has been evident trough the presentation of the governments at the intergovernmental meetings.
- Holding of the national advisory group meetings.
- Experts from national advisory groups are assisting the governments on Malé Declaration activities. For example, a national advisory member from Sri Lanka is participating in the health impact assessment work in Sri Lanka.

Mechanisms for consulting with national stakeholders differs from country to country. For example, the national level consultation in Bhutan is being conducted by one single network for all the environmental issues. Considering the current level of expertise, it is not feasible to establish a separate national advisory group dedicated to air pollution issues in Bhutan. Therefore, there is a need to implement a flexible approach on the structure and role of the national advisory group and stakeholders' network.

5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

Activities of the National Advisory Group are coordinated by the NIAs. The national level project managers participated in the meetings of the National Advisory Group and provided briefings on other components of RAPIDC activities.

6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

The new institutional arrangement proposed for the Malé Declaration at the IG8 meeting in Bhutan, envisages specialised institutions in the focus areas. This will help countries to take the lead, become more involved and gradually build their capacities. Future activities for strengthening the national structure include:

- National stakeholder consultation in Sri Lanka is being planned for 12 June 2007 by the Central Environmental Authority, Sri Lanka
- Convene two additional national stakeholders meetings during 2008. Bhutan and Nepal are the potential countries. The final decision will be made by the countries during IG9.
- Assist the countries in the establishment of data verification group

8. Any other relevant comments/grievances etc

LFA 2 Monitoring

As all the monitoring projects are highly related the four projects below are assessed under one section.

LFA 2.1 Strengthen monitoring network

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 2.1 Strengthen monitoring network	**Project Number:** 730 215
Lead institution: UNEP RRC.AP (Project leader) IVL (technical support)	**Prepared by:** RRC.AP with input from IVL
Collaborating Institutions: (name; principal contact; contact details) SEI (as required by the project);NIAs (as part of contract with UNEP)	

LFA 2.2 Training in monitoring

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 2.2 Training in monitoring	**Project Number:** 730 215
Lead institution: UNEP RRC.AP IVL	**Prepared by:** UNEP RRC.AP
Collaborating Institutions: (name; principal contact; contact details) SEI; NIAs and Technicians	

LFA 2.3 QA/QC Programme

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 2.3 QA/QC Programme	**Project Number:** 730 215
Lead institution: UNEP RRC.AP IVL	**Prepared by:** UNEP RRC.AP with input from IVL
Collaborating Institutions: (name; principal contact; contact details) SEI; NIAs; AIT (reference laboratory)	

LFA 2.4 Pollutant movement to monitoring sites

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 2.4 Pollutant movement to monitoring sites	**Project Number:** 730 215
Lead institution: UNEP RRC.AP (project leader); SMHI (technical support)	**Prepared by:** UNEP RRC.AP with input from SMHI
Collaborating Institutions: (name; principal contact; contact details) NIA nominated meteorologists; MoC	

Assessment and analysis of progress:

1. Outline of original project

Strengthening the monitoring capacities based on common methodologies and protocols established during Phase II at the national level is one of the major tasks for the implementation of Phase III of the Malé Declaration. The current monitoring network under the Malé Declaration is capable of monitoring air quality as well as rainwater analysis. Activities under Phase III implementation include sorting out any difficulties with equipment in any of the sites and introducing additional pollution parameters for air quality and rain water monitoring at the sites established in remote areas (1site/country) in Phase II. This Phase is also introducing new sites.

Strengthening the monitoring capacities of personnel in the Malé countries based on common methodologies and protocols is one of the major tasks for the implementation of Phase III of the Malé Declaration. This is one of the key activities for development of regional capacity.

Phase III includes the implementation of a QA/QC programme and training in data handling and evaluation, and it also has introduced the NIAs to trajectory models that are freely available on the web and provided training on the usage of the trajectory models and discuss the scientific background, the uncertainties and suitable usage of trajectories.

2. Describe any deviation from original plan(s) and budget (with reference to current financial statement)

According to the work plan, the diffusive sampler inter-comparison is somewhat delayed, but will be carried out within Phase III and is currently underway.

According to the work plan, the inter-laboratory comparison of precipitation analysis (part of the QA/QC procedure) is somewhat delayed, but will be carried out within Phase III.

These two delays are due to the longer time required for the national inputs on available passive samplers and the development of a protocol for the inter laboratory analysis.

3. Results, outcomes and deliverables

LFA 2.1 Strengthen Network

During the eighth intergovernmental meeting, the monitoring committee - MoC, introduced the proposed plan for further development of the monitoring network. It included: (i) updating and integrating the technical and user manuals and other recommendations (Malé Declaration/IG 8/2-1, Annex 1.3); and (ii) suggested changes for improving data quality in the Malé Declaration Monitoring Network (Malé Declaration/IG 8/2-2 Annex 1.4). The Session was invited to provide comments on the proposal. The meeting agreed that the technical manual would be revised and the proposed changes for improving the data quality will be implemented, based on discussions and further comments from NIAs, if any.

2.1.1 Continue monitoring established in phase II

The details of the monitoring sites established in South Asia by the Malé Declaration since 2003 are shown in Table 2.1. The status of the monitoring activities in the Malé Declaration sites is summarized in Table 2.2 and details are described below.

The MoC has decided not to recommend the use of active bubblers for monitoring SO_2 and NO_2 in air since the concentration at the remote sites have been shown to be below the detection limits for the

technique. The reason for choosing this equipment was to build regional capacity and the technique was regionally recommended since it is a widely used technique in the region. A more suitable technique will be introduced in the monitoring manual. The high Volume Samplers will now be used for TSP and PM_{10} only.

Ozone monitoring has now been introduced. IVL diffusive samplers were sent to all countries in April/May 2006. Ozone data has already been received from all the countries.

To build capacity for wet chemistry analysis, the installation of an Atomic Absorption Spectrophotometer (AAS) in Sri Lanka has been completed. For Bangladesh, Bhutan and Nepal, AASs were dispatched during Oct 2006 and training will be carried out over the next few months.

Table 2.1: Details of Malé Declaration monitoring sites

Country: Bhutan **Station:** Gelephu **Latitude and longitude:** 27° 0' N; 90° 30' E **Altitude:** ~ 350m **Site type:** Remote site close to Jigme Singye Wangchuk National Park and Manas National park **Met. Station:** Automatic and manual equipment at site. **Accessibility of Site:** Poor - 300Km SE of Thimpu	**Country: Bangladesh** **Station:** Nurnagar, approx. 10 km North of Sundarbans Forest, close to Indian border in SW-Bangladesh **Latitude and longitude:** N22° 18'; E89° 3' **Site type:** Semi-(rural/remote), i.e. small roads and small houses nearby, but no major pollutant sources **Met. Station:** Shatkira, ca. 30 km North of Sundarbans Forest **Accessibility of Site:** Poor
Country: Iran **Station:** Chamsari **Latitude and longitude:** N 32° 24 E 47° 31 **Site type:** Rural site, is 40 km south of the town Dehlaran and about 200 km south of Ilam, the headquarter of the province. **Met. Station:** - **Accessibility of Site:** Poor	**Country: India** **Station:** Port Canning **Latitude and longitude:** N 32° 24 E 47° 31 **Average annual rainfall:** 1750 – 1800 mm **Dominant wind direction:** N to NE during winter and S to SW in summer **Site type:** Rural site, close to Sunderbans. **Met. Station:** - **Accessibility of Site:** Possibility of reducing the monitoring frequency due to increase in the cost of transportation.
Country: Maldives **Station:** Hanimaadhu **Latitude and longitude:** **Altitude:** ~2 m **Site type:** Remote site, in the northern most atoll of Maldives located about 400 km north of the country's capital, Malé. **Met. Station:** ABC **Accessibility of Site:** Fair	**Country: Nepal** **Station:** Rampur **Latitude and longitude:** N 27 ° 38'; E 84 ° 20' **Altitude:** 164.95 m **Site type:** Rural site, located about 15 km south of the Royal Chitawan national park. **Met. Station:** on site **Accessibility of Site:** Poor. Delayed communication between NIA and the staff at the site on issues like chemicals running out. Plus, there is restriction in travelling to the site, due to political disturbances.
Country: Pakistan **Station:** Bahawalnagar, on the Indo-Pakistan border **Latitude and longitude:** - **Site type:** Rural site, in the north-eastern part of Pakistan **Monitoring parameters and status:** **Met. Station:** **Accessibility of Site:** There may be difficulty in moving samples from the border to Islamabad	**Country: Sri Lanka** **Station:** Dutuwewa **Latitude and longitude:** N 8 ° 20'; E 80 ° 45' **Altitude:** ~ 100m **Site type:** Remote site, in a forest in the north-central part of Sri Lanka **Monitoring parameters and status:** **Met. Station:** **Accessibility of Site:** Poor – new more accessible station being selected.

Bangladesh

The monitoring station has been established in a permanent site and continuous monitoring is being carried out for most of the required parameters. The High Volume Sampler for TSP and PM_{10} has never been routinely used in Bangladesh due to lack of electricity (general problem of the area). The NIA hopes that the site will be connected to the electricity grid within one or two years. In the meantime the MoC are looking into battery powered alternatives. The AAS provided by the Malé Declaration has now been installed at the DoE office in Khulna (the initially missing lamp has been sent and installed). Training by Envirotech will take place in May 2007 and it is hoped that wet chemistry analysis will commence after that.

Table 2.2: Monitoring Status of the Malé Declaration sites, April 2007

Parameter	Bangladesh	Bhutan	India	Iran	Maldives	Nepal	Pakistan	Sri Lanka
TSP	no	yes	Yes	Yes	No	Yes	No	No
PM_{10}	no	No	Yes	Yes	No	Yes	No	No
SO_2, NO_2, O_3 with passive sampler	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SO_2, NO_2 with active method	no	Yes	Yes	Yes	No	Yes	No	No
pH (rain water)	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
pH (Surface water)			Yes					
EC	Yes	Yes	no	Yes	Yes	Yes	Yes	Yes
Rain Chemistry (Mg^{2+}, Na^{+}, K^{+}, Ca^{2+}, NH^{4+}, SO_4^{2-}, NO_3-, Cl-)	no	no	yes	yes	no	No	no	Yes

Bhutan

The monitoring station has been established in a permanent site and continuous monitoring is being carried out for most of the required parameters. The MoC visited the monitoring site in Bhutan in September 2006. The wet only collector was out of order and the plastic parts of both w/o and bulk collector were broken. Spare parts for the monitoring sites were provided to Bhutan during the regional training and refresher course in March 2007. PM_{10} measurements are not presently conducted at the site because the HVS was moved to the capital, Thimpu, after continued problems wit the power supply. The MoC are looking into alternatives. Wet chemistry will commence when the AAS installation is complete.

India

The monitoring station has been established in a permanent site and continuous monitoring is being carried out for most of the required parameters. The project manager for Malé Declaration has changed. Now a new project manager has been appointed. The lack of pH and EC data submissions is being investigated by the MoC.

Iran

The monitoring station has been established in a permanent site and continuous monitoring is being carried out for most of the required parameters. Spare parts for the monitoring sites were provided to Iran during the regional training and refresher course in March 2007. The low rainfall at the site will limit wet chemistry measurements.

Maldives

The monitoring station has been established in a permanent site and continuous monitoring is being carried out for most of the required parameters. The HVS is not yet in use and the MoC is investigating logistics for PM measurements.

Nepal

The monitoring station has been established in a permanent site and continuous monitoring is being carried out for most of the required parameters. The Automatic Weather Station has a problem with its data logger and is currently not in use. The other problems faced by the station include: 40 hrs/week of load shedding during dry season, cracked lid and, battery breakdown of Wet Only Collector, and difficulties in travelling to the site. Spare parts are being provided and wet chemistry should commence when the ASS installation is complete.

Pakistan

The Pakistan NIA has now established a remote Malé Declaration monitoring station at Bahawalnagar, which is situated on the Indo-Pakistani border. The monitoring site is placed in the premises of Pakistan Meteorological Department (PMD), Bahawalnajar. This was the eighth and final MD site to be established after the start of the installation period in 2003. Delays to its establishment were caused by sensitivities over the placement of the site near the border with India. In the interim period, Pakistan has been monitoring at an urban site in Islamabad. Due to the limitations of the personnel employed at the site, in wet deposition they monitor electrical conductivity and pH only and with HVS they monitor the particulates only.

Sri Lanka

The monitoring station has been established in a permanent site and continuous monitoring is being carried out for most of the required parameters. A new project manager has been appointed, as the previous one has been promoted, and they have made plans to continue the project for the next 4 years. They are planning to change the monitoring site due to difficulties in accessibility, voltage drops and for better protection of the instruments. Spare parts for the monitoring sites were provided to Sri Lanka during the regional training and refresher course in March 2007. The AAS was successfully installed and wet chemistry analysis is ongoing.

2.12 Establish database

An Access based database for the Malé air and precipitation monitoring data has been installed at UNEP RRC.AP. Most of the countries sent their data to UNEP for the centralised database. The Secretariat updated the database with monitoring data from NIAs and analysis of passive sampler data from IVL. A data report was compiled for data submitted up to March 2007 for discussions during the regional training and refresher course in March 2007 at UNEP RRC.AP. The regional database is available online for the NIAs at: http://www.rrcap.unep.org/airIndicator/index.cfm.

2.1.3 Strengthen sites

Site audits have been completed for Bhutan and Sri Lanka. The MoC had a meeting on 13 September 2006 (in Thimphu) to discuss the timetable for site/laboratory audits during 2007, elaboration of audit protocols and revision of the manuals. MoC (Martin Ferm) will visit Bangladesh for a monitoring site audit during 7-8 May 2007 and it is hoped that other audit visits will be conducted by the MoC by the end of 2007. The Secretariat is developing a site audit plan for the remaining sites.

2.1.4 New sites

IG8 decided to install three new sites as part of the work plan for 2007. MoC members will be involved in the establishment of three new remote sites at Sri Lanka, Iran and Bhutan. This was included as one of the activities in the MoU with each selected NIA. Sri Lanka and Bhutan are now working on site selection. As stated in the proposal these new sites will rely on passive samplers and rainwater collection only.

2.15 Review technical manual

The review of the MD technical manual was discussed by the MoC at the Refresher Training course in Bangkok, March 2007. Sections for upgrading were identified and the updated manual will be ready by the end of this phase.

2.1.6 Passive sampler inter-comparison

Pakistan and Sri Lankan NIAs are participating in the passive sampler inter-comparison along with the National Building Research Organisation (NBRO), Sri Lanka. Dr. Rajasekhar Bala, National University of Singapore (NUS), presented the proposed Passive Sampler Inter-comparison study for the Malé Declaration, to compare the performance of different designs of Passive Samplers during the regional training and refresher course, in March 2007 at UNEP RRC.AP. He gave a brief introduction about Passive Samplers, the different types, features, and their advantages. The options available to the Malé Declaration are either to have a laboratory in the region to analyse indigenous /commercial Passive Samplers, or to conduct studies to find suitable alternative Passive Samplers that can be produced and analysed in the region. The Passive Sampler design, the chemical absorbent used and the quality of the laboratory analysis are important for obtaining good results. The proposed study will have two main components: to implement a Passive Sampler inter-comparison and to compare Passive Samplers with active samplers. The experiment is scheduled to start from June 2007. NUS would lead the study, while UNEP RRC.AP and SEI would help NUS in developing and facilitating the study. The details of the proposed methodology were mentioned in Dr. Bala's presentation and ToRs are currently being agreed between UNEP RRC-AP and the institutions in the Malé countries.

2.2 Training

The fifth regional training and refresher course on monitoring transboundary air pollution was held at UNEP RRC.AP, during 27 – 30 March 2007. The major objective of the training was to introduce the Quality Control and Quality Assurance (QA/QC) programme; and to discuss the issues encountered in operating the monitoring sites in each country. The training program was attended by laboratory technicians and project managers in charge of each Malé Monitoring Station in participating countries as well as the members of Monitoring Committee (MoC), SEI, IVL, UNEP RRC.AP and AIT as a reference laboratory. Laboratory sessions were conducted at AIT EE laboratory. The report of the training is available at http://www.rrcap.unep.org/md/malereport/.

2.3 QA/QC Programme

A draft protocol for the inter-laboratory comparison was presented to the participants during refresher training on 27 March 2007. The outline of the QA program for the inter-lab comparison was also mentioned during the training period. The first attempt would be made during June-July 2007, and the second attempt during February-April 2008.

2.4 Study movement of air pollution

An introductory lecture on trajectory analysis and some hands-on exercises were given to representatives from all Malé countries during emissions inventory training workshops at UNEP/RRC-AP, Thailand in 3-8 July 2006 and February 2007 and further information on conducting trajectory analysis was also presented at the monitoring refresher course held in March 2007.

4. Assessment and analysis of progress:

This section analyses the areas where further development is required. The Malé Declaration monitoring network was established in 2003 as part of the Phase II activities and since that time efforts have been made to train the staff running the sites in routine monitoring procedures and upkeep and calibration of equipment so that results of a high quality can be produced. These procedures are described in the Malé Monitoring Manual which is based on the EANET manual. The current monitoring status in each country (Table 1) is still not 100% for all parameters being measured but good progress has been made over the last four years. Many problems have been encountered, in particular because of the remote nature of most of the sites, and some of the more important ones are listed below:

(i) Monitoring of SO_2 and NO_2 by passive sampling has been on-going in most of the countries since 2003. Passive ozone samplers were introduced during spring/summer 2006. Earlier there was problem with the registration of exposure dates for the diffusive samplers, as well as logistics with sending samplers, but now the situation has improved.

(ii) Concerning deterioration of some material used in the precipitation collectors, a replacement of the material used is difficult. However, there are discussions with the instrument providers to find alternatives that can withstand the local climatic conditions. For the time being, funnels etc. are just being replaced as they become unusable.

(iii) Some countries have reported problems with electricity supply and logistics at their sites, and Sri Lanka has decided to move theirs to a more easily accessible area. Other problems such as storage and transport of rain water samples and the use of preservatives, have also been discussed and the MoC will be making recommendations in the revised manual.

(iv) Trajectory analysis was to be used in conjunction with the monitoring data collected at the Malé monitoring stations. Trajectory calculations can help understanding variations in the monitoring results. Although the NIAs have had some training in trajectory analysis it would seem that more exposure and training is required for NIAs to utilise the freely available trajectory tool to interpret the monitoring data collected at the site or investigate possible transport routes of long-lived (day to weeks) pollutants. Therefore, the needs and requirements of NIAs will be determined and dealt with in the next training programme.

(v) The Malé Declaration training programme for monitoring has always tried to train the most suitable personnel from each country who are involved with the routine upkeep of the sites. This has not always been possible and there have been problems with continuity as staff are promoted or are moved to other duties. However, at the training workshop held at UNEP RRC.AP in March 2007,

focussing on hands-on training, QA/QC routines and data validation, the participants showed strong commitment and mostly had a good level of understanding of what was required and sufficient laboratory experience. The data monitored so far by each country were presented and the sampling and data quality problems encountered were discussed with each NIA. The refresher course is the best opportunity for the participating countries to discuss problem encounter during collection of monitoring data and this is ongoing.

(vi) Wet deposition measurements and analysis have been one of the hardest elements to get established in the Malé Declaration countries and it has taken a few years to even get pH and EC monitored consistently. It is interesting that a country with as much experience as India has not yet submitted rain chemistry data but this is currently being looked into. Four countries, Bangladesh, Bhutan, Nepal, and Sri Lanka, have been bought Atomic Absorption Spectrometers by the project to aid analysis for rain chemistry and these are now coming on line.

(vii) There have been problems for countries to get permission to send staff to training events on time, particularly for India and Bangladesh. This situation is currently being reviewed.

Overall, the regional training programme and QA/QC programme are part of capacity building developments which will strengthen the monitoring capacity and network based on the common methodologies and standards at the national level. The regional training programme gives the participating countries to the experience in developing national monitoring stations and having a sense of ownership. Most of the countries have nominated permanent technical personnel in-charge of monitoring at the sites. There were two regional training programme and three in-country training programmes were held during Phase III implementation. This has helped to ensure that monitoring capacity and implementation of QA/QC routines will be enhanced in the region.

During the stakeholder meeting held in Bhutan on 12-13 September 2006, the necessity of applying stringent QA/QC in data collection and analysis in order to get credible data was stressed. A critical issue will be to ensure sustainable monitoring activities in the countries, and to support the Malé Declaration countries and the reference laboratory in their efforts to keep the quality of sampling and analysis at a high level. The role of the reference laboratory will be of crucial importance with respect to arranging refresher courses, offering country-specific training, organising inter-laboratory comparisons etc. Efforts are being made in the final year of this phase to get all measurements and QA/QC practices operational.

Continuation of monitoring activities will help develop the monitoring data quality as the countries get more experience in data analysis.

5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

Malé Declaration, EANET, and the ASEAN Haze agreements are the major intergovernmental agreements on transboundary air pollution in Asia. Malé Declaration implementation is strongly linked with the other two intergovernmental agreements, since UNEP hosts the secretariat for EANET and participated in the development of ASEAN haze agreement. For example, the technical manual for the Malé Declaration was developed based on the EANET technical manual.

Another example is the linkage between the Malé monitoring sites and Atmospheric Brown Cloud project sites in Nepal and Maldives. In Nepal, the measurements and infrastructure for the ABC project, installed at ICIMOD HQ, is complementing that of the Malé activities. In Maldives, a new station is being established in the southern island of Gan as part of the ABC network. Some of the

Malé Declaration instruments that were lying in Maldives, are being co-located in this station and hence no additional funding is required for its establishment.

The monitoring network of the Malé Declaration is using the expertise of CAD and AIRPET programmes for the passive sampler inter-comparison and development of inter-laboratory comparison protocol respectively.

6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

NIAs will continue to operate the existing observatories. Data that will be received from the continuous monitoring will be added to the regional database and a data report for 2006/2007 will be compiled by the secretariat.

Site/laboratory audits, to be performed by the Monitoring Committee, are planned for most of the countries within the last year of Phase III, and audit protocols have been elaborated. A revision of the monitoring manuals will be done, based on the suggestions given in the notes presented and the discussions at the meeting in Bhutan in September 2006. For example, Standard Operating Procedures (SOP) will be introduced to improve the data quality.

The passive samplers used in the programme are provided and analysed by IVL in Sweden. An inter-comparison exercise will be performed within Phase III, including passive samplers already in use in some of the countries, in order to check their performance and to enable recommendations to be made for the possible use of suitable alternative methods within the Malé Monitoring Programme.

A regional level training programme will be organised in 2008 to improve the quality of the data quality.

LFA 3.1 Develop capacity for emission inventories

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 3.1 Develop capacity for emission inventories	**Project Number:** 730 315
Lead institution: UNEP RRC.AP (Project leader) SEI (technical support)	**Prepared by:** UNEP RRC.AP/SACEP with input from SEI (Harry Vallack of SEI is responsible for the technical advice on the emissions)
Collaborating Institutions: (name; principal contact; contact details) NIAs (UNEP contract); SMHI (with SEI)	

Assessment and analysis of progress:

1. Outline of original project

The aim of this activity is to develop capacity within all NIAs of the Malé Declaration countries to compile national emissions inventories of the main regional air pollutants in a consistent format using the manual and workbook that has been prepared in Phase II. This will provide a quantitative basis for regional modelling of the transport, deposition and impacts of these air pollutants and so enable informed regional planning for the prevention and control of these emissions. The manual will also be developed further (by SEI) to include CO, NMVOC and $PM_{2.5}$ emissions, methods for estimating soil dust emissions and methods for spatially distributing the emissions.

A series of four training workshops will be held for personnel designated by NIAs to undertake the emission inventories, based upon the manual and workbook produced in Phase II. During the course of this activity, an emissions inventory for each of the participating countries will be produced in the same *Malé Declaration Air Pollutants Emissions Inventory Manual* format. The workshops will be held in S. Asian countries coinciding with other Malé Declaration meetings where possible.

2. Describe any deviation from original plan(s) and budget

It was decided to have three emissions training workshops rather than four and to run these concurrently with the scenarios, policy interventions and integrated assessment modelling workshops.

3. Results, outcomes and deliverables

- The Malé emissions inventory manual was updated to include two more pollutants required for ozone modelling (CO and NMVOCs) and an extra category of particulate matter ($PM_{2.5}$) of more relevance to human health.
- The first training workshop on emission inventory preparation was held 3 - 5 July 2006 at UNEP RRCAP, Thailand. The workshop provided a hands-on training to the participants from Malé Declaration countries on compilation of emissions inventories of all the major regional air pollutants. The report is available at www.rrcap.unep.org/md/Maléreport/.
- The second training workshop on emission inventory preparation was also held at UNEP RRCAP, Bangkok, Thailand from 26th - 28th February 2007. Fourteen participants from seven countries attended the training workshop (India was not represented). Eleven of the participants had attended the first workshop and three were new. They were drawn from the Government agencies dealing with environment and meteorology. The participants presented the major findings of the emission inventory they had carried out since the first workshop. The data collated from a variety of sources, were summarized in terms of absolute values/percentage shares of the pollutants and their sources. The participants highlighted the challenges faced by them in getting data and information, especially in the form required to be input into the emission inventory worksheet. The training workshop then focused on quality assurance / quality control issues and compilation of Large Point Source emissions.
- Email Forum: The participants of the 1st workshop requested an electronic discussion forum to facilitate the technical discussions on emission inventory, scenario, and modelling. The Secretariat has established an email discussion forum. Participants can send their technical concerns to the following email, which will automatically be distributed to all participants: MD_IIAS@rrcap.unep.org .

4. Assessment and analysis of progress:

Capacity in emissions inventory compilation has been considerably enhanced in the Malé Declaration countries as a result of this activity. These countries are now compiling their national inventories for the baseline year 2000 using the updated version of the Malé emissions inventory Manual and Workbook. It is expected that they will have reasonably accurate draft national inventories to present at the last emissions workshop to be held early in 2008.

The project will provide input data for the regional-scale atmospheric transport modelling required to estimate impacts. It will also provide the basis for analyses of likely future emissions (and hence impacts) according to different scenarios. This will thus inform policy makers and the public how to

set objectives and priorities for monitoring and reducing emissions and to develop current and future mitigation strategies.

5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

The emissions workshops have been combined with the workshops on scenarios (LFA 3.2), policy (5.1) and integrated assessment modelling (3.3) so that the same people are involved and can link the activities together.

6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

The 3rd and final emissions inventory workshop will be held early in 2008 at UNEP RRCAP, Bangkok, Thailand. Each country will present their inventory reports for scrutiny, QA/QC troubleshooting etc. The emissions data will then be entered into the atmospheric transport model to generate a more accurate picture of near surface air concentrations, deposition loads and likely effects of the pollutants across the region.

For the next phase, it was suggested that there be peer review of the work among the 8 country teams and that the inventories be updated with 2005 data. The Malé inventory workbook needs to be progressively improved by, for example, incorporating allocation matrices to allow temporal and spatial disaggregation of data, refining the methodology for road transport emissions, inclusion of methodologies to help estimate activity variables for different sectors, estimation of suitable default emission factors, especially for $PM_{2.5}$, estimation of areas of vegetation burnt, and speciation of NMVOCs into reactivity classes. The specific areas/sectors for which methodologies need to be developed were forest / vegetation fires, road transport, small scale industries (e.g. brick kilns) and natural emissions. A new projections/scenarios option module within the workbook and to assess the existing emission reduction policies in the countries would also be very useful.

LFA 3.2 Develop capacity in emission scenario development

RAPIDC Annual Report 2007	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: LFA 3.2 Develop capacity in emission scenario development	**Project Number:** 730 325 & 730 515
Lead institution: IIIEE at Lund University (reporting to SEI York)	**Prepared by:** IIIEE at Lund University
Collaborating Institutions: **Institution:** IIIEE at Lund University **Principal Contact:** Philip Peck **Contact Details:** Tegnérsplatsen 4, SE-221 00 LUND, Sweden **Phone:** +46 46 222 0225 **E-mail:** philip.peck@iiiee.lu.se **Institution:** SEI York **Principal Contact:** Johan Kuylenstierna **Contact Details:** Johan Kuylenstierna + 44 (0)1904 432892 jck1@york.ac.uk Kevin Hicks: +44 (0)1904 432896 khicks@york.ac.uk Harry Vallack: + 44 (0)1904 432894 hwv1@york.ac.uk	

Assessment and analysis of progress:

1. **Outline of original project**

The aim of this activity is to develop capacity within all NIAs to create transboundary air pollutant emissions scenarios for the Malé Declaration countries. These will be used within the Integrated Information and Assessment System (IIAS) to project future deposition levels and their impacts and so enable informed regional planning for the prevention and control of these emissions.

An initial document (prepared by IIIEE) outlining methods for scenario development will be discussed 'back to back' at the (1st or 2nd) emissions workshop (Activity 3.1). The NIAs and their emissions experts will be invited to help formulate the scenario methods. The methods will then be progressed and a scenarios manual refined at a following workshop. NIAs will then use the manual to create scenarios for each of the Malé Declaration countries which can be used, via the emissions inventory workbook and IIAS, to project future deposition levels and their impacts according to the alternative scenarios generated.

Technical advisers from IIIEE will prepare the initial document outlining methods for scenario development. With help and input from the NIA emissions experts during the initial emissions/scenarios workshop, a draft Malé Declaration Scenarios Development Manual will be produced and then refined at the following workshop.

2. **Describe any deviation from original plan(s) and budget**

Final deadlines and budget are still considered to be realistic.

3. **Results, outcomes and deliverables**

During the past 12 month period, the major outcomes from this work were delivery of training workshops and production of documentation. Two scenario training workshops were held at UNEP-RRCAP, Bangkok, Thailand the first in July 2006 and the second in February/March 2007). A questionnaire addressing training content and needs (*Assessment of training course and needs: Scenarios & Policy Training, AIT Bangkok Thailand 5-6 July 2006*) was generated, distributed, analysed and documented. A working draft document entitled 'Development of Emission Scenario background and procedure manual: *Manual for the Development of Emission Scenarios for Air Pollution Prevention and Control in South Asia'* was presented in Bangkok in July 2006. A more advanced draft was then issued for a second round of review - and as a support for training - at the February 2007 workshop.

4. **Assessment and analysis of progress:**

Knowledge of scenarios is being provided and there has been increased capacity in this area as a result. However, tangible capacity building requires more applied application. To this end, a scenarios interface with the emissions inventory workbook urgently needs to be developed and training in its use provided.

5. **Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally**

The scenarios workshops have been combined with the workshops on emissions (LFA 3.1), policy (5.1) and integrated assessment modelling (3.3) so that the same people are involved and can link the activities together. The IIIEE work continues to draw extensively upon the work of existing air pollution initiatives in the region and internationally.

6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

Planning discussions for the incorporation of scenarios analysis into the *integrated information and assessment system* (IIAS) are ongoing. In particular, the emissions inventory workbook should be developed further to enable scenario assumptions to be input in a user-friendly manner and so enable assessments of alternative emissions reduction policies in the countries to be explored. Further capacity building will be required in scenario development and use of the new software within the overall context of the IIAS. .

LFA 3.3 Develop regional IAM

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 3.3. Develop regional IAM	**Project Number:** 730 335
Lead institution: UNEP RRC.AP (project leader) SEI and SMHI (technical support)	**Prepared by:** UNEP RRC.AP with input from SMHI and SEI
Collaborating Institutions: (name; principal contact; contact details) NIAs, SEI and SMHI	

Assessment and analysis of progress:

1. Outline of original project

Outline of original project: The aim was to upgrade the regional integrated assessment capability of the Malé Declaration through upgrading the regional integrated assessment model, install the MATCH atmospheric transport model at UNEP and hold training in the use of the IAM and atmospheric transport models. The Integrated Assessment Model (IAM), developed in the previous phase for use by the NIAs, is designed to quantify the deposition and impacts of regional air pollutants within S. Asia, both now and in the future. This will facilitate informed regional planning for the prevention and control of transboundary air pollutant emissions.

The basic IAM developed during Phase II will be upgraded so that it can accept the nationally derived emissions and scenarios and attempt to include information relevant to assess acidification, regional health and crop impacts. For this purpose the ozone and particulate matter calculations are required from MATCH as inputs and linked in a useful way to impacts. An important aspect is also discussions as to what is included in the IAM as well as training in its usage.

The heart of the IAM is the atmospheric transport model. The model currently being used is MATCH (Mesoscale Atmospheric Chemistry model). In this phase the intention is to set up the MATCH model so it can produce ozone- and PM-data for the Malé region, and this activity also includes compilation of relevant input data (emissions, meteorology, measurement data to validate the model with, etc.). The modelling results should be (1) shared with relevant "effects studies" within the RAPIDC project, (2) published in scientific journals, (3) presented at relevant meetings and (4) incorporated in the IAM developed at UNEP RRC/AP. It was also felt important to install MATCH at a relevant institute in Asia so NIAs feel they are not dealing with a "black box" when working with the IAM model. An installation would also increase the modelling capacity in Malé region. Access to a modelling tool

would stimulate the national emission inventories and the understanding and usage of monitoring data. Through training it was intended that the NIAs would get a background on what a chemistry-transport model is and how it is used.

2. Describe any deviation from original plan(s) and budget (with reference to current financial statement)

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3. Results, outcomes and deliverables

In the development of the IAM in Phase III it was decided that as well as performing the calculations to assess the impacts of air pollutants using different emissions and scenarios, the tool was a useful place to put all of the technical information from the Malé Declaration. Therefore, all of the manuals are included as well as a link to the monitoring database. The idea is that that user can understand all of the science and concepts included in the model by reading text that can be accessed by the tool. Thus, the system has been renamed the Malé Declaration Integrated Information and Analysis System (or IIAS).

The development of the IIAS is a joint effort with UNEP providing the computing expertise to create the system, SEI providing the technical advice on the design of the IIAS, SMHI providing the MATCH model results and advice on the structure and SEI and IIEE providing the links to the emissions, scenarios and policy options. These linkages are still to be developed and it is planned that a scenario and policy generator attached to the emission inventory workbook will be produced for some key sectors and fuels, but not all. The remainder of the work on the scenarios and policy options for other sectors would fall outside this phase. A version of the IIAS has been produced with the various explanations, manuals and many of the intended calculations for sulphur and nitrogen deposition. Main results are:

- For the first time NIAs can link the modelled deposition and concentrations with the Malé monitoring data
- For the first time the NIAs can alter the emissions from the regions and interrogate the changes in deposition, concentration and estimates of the risks of acidification and SO_2 damage to lichens, crops and natural vegetation.
- There is a now a platform where all of the results of the Malé Declaration technical exercises are collected in one place.

Further development includes polishing the current version and making sure it works on all platforms and the inclusion of further pollutants, ozone and particulate matter, and to work out how to calculate and illustrate the risks of these pollutants to crop yield and human health and, if possible, for corrosion.

The MATCH model has been used to produce source-receptor relationships for SO_2, nitrate and sulphate concentrations in rainwater and total deposition. Ozone calculations have also been made based upon the EDGAR emissions data. Emission data for Iran is not available at the same accuracy as for the rest of South Asia. Iran has therefore not been included in the present ozone calculations.

The MATCH model has been installed at UNEP RRC/AP during November-December 2006. Limited training was given to the staff at UNEP RRC.AP on its handling in February 2007. The model system can also be operated from SMHI in Sweden. Training of dispersion modelling in general was given to

the NIAs at the workshop in July 2006 and a description of MATCH, in particular, with a demonstration of its usage, was given to the NIAs at the workshop in February 2007.

The first training workshop on emission inventory preparation, scenarios generation, atmospheric transport modelling, and integrated assessment modelling was conducted 3 - 8 July 2006 at UNEP RRCAP, Asian Institute of Technology (AIT), Bangkok, Thailand. The training workshop was aimed at capacity building in eight Malé Declaration countries for studying air pollution issues and their integration, especially transboundary transport of air pollutants, their potential impacts, and consequently enabling them to design science-based, integrated policy options to mitigate the adverse effects of air pollution. Thus, the workshop was designed to provide a technical hands-on training to the participants from Malé Declaration countries on the integration of the emissions inventories of major regional air pollutants, generation and analysis of various scenarios, atmospheric transport/transfer/deposition modelling, impacts and abatement of air pollutants within the IIAS. The IIAS was presented to the NIAs and they were able to play with it and discuss next steps with a view to fulfilling their requirements. The UNEP RRC.AP compiled the proceedings of the workshop and distributed through internet. (www.rrcap.unep.org/md/Maléreport/).

The second training workshop was held at UNEP RRCAP, Bangkok, Thailand from 26th February to 2nd March 2007. Fourteen participants from seven countries attended the training workshop. Eleven of the participants had attended the first workshop and three were new. They were drawn from the Government agencies dealing with environment and meteorology.

Email Forum: The participants of the workshop held on 3-8 July 2006 requested an electronic discussion forum to facilitate the technical discussions on emission inventory, scenario, and modelling. The Secretariat has established an email discussion forum. Participants can send their technical concerns to the following email, which will automatically be distributed to all participants: MD_IIAS@rrcap.unep.org .

4. Assessment and analysis of progress:

The IIAS structure and functioning is now improving to a point when it can be generally released. Until now it has only been used as part of the training sessions and is in a rather nuts-and-bolts format just now. It is necessary to ensure that the IIAS is sufficiently polished for general release (amongst Malé participants). The importance of the integration was seen when the monitoring data is queried in combination with the modelling data – and the inter-comparison of the atmospheric transfer model with monitoring data can start. This occurred at the training session and provoked a lot of interesting discussion and participants started to see how the different bits o the puzzle start to interlink.

From analysis thus far, the scale of the modelling and the magnitude and distribution of emissions seem very important parameters. The improved national emissions are clearly important when these are of a sufficient standard for use in the IIAS. Fully developed inventories will not be available during the present RAPIDC period, but draft inventories for each country are expected to develop country totals at least (see LFA 3.1). These can easily replace the current totals in the IIAS, but the disaggregated distribution across countries may have to await the next phase. Once these inventories have been produced it will be possible for the continual improvement of emissions, modelling and monitoring to begin.

The integration of the MATCH results with the IAM has proved to be complicated. A lot of time is devoted to converting file format and checking trivial unit conversions etc. Near-surface ozone will most likely increase in the region and thus ozone induced damage to crops will most likely increase.

Therefore, this is an important parameter to include in the IIAS but at this stage it is unclear whether it is worthwhile to derive source-receptor calculations of ozone, or whether the outputs of MATCH and the risk analysis will merely be represented in IIAS, but not linked to the emission inventory and scenarios. This is due to the complexity of the source-receptor relationships for ozone. The PM modelling with MATCH for use in the IIAS is behind schedule. For both ozone and PM, South Asia needs high-quality measurements and modelling of concentrations for comparison to the modelled data. Mitigation will only take place when countries prioritize measures that will reduce emissions of ozone precursors (NO_2 and hydrocarbons). That is probably not prioritized by politicians and the general public today.

Models are needed to understand processes in the atmosphere and to assess, for example, the role of long-range transport of pollutants. Modelling capacity is available at some institutes in the region. Some institutes may have developed their own model while most institutes probably take advantage of the multitude of models that can be downloaded from various agencies , mainly in Europe and USA. Models need input data (emission inventories, land-use classification, etc.) which is often lacking in this part of the world. Operating atmospheric transport models in the region will stimulate the build-up of relevant input data for models (that are needed to understand the processes in the atmosphere). Models need data for verification (representative, high quality measurements of atmospheric concentrations and surface deposition). Operating models in the region will create a strong incentive for collecting data of high quality throughout the region. By combining the different inputs in the IIAS, the linkages and needs for high-quality data are made particularly clear.

The MATCH model has been installed at UNEP and personnel at UNEP RRC/AP are being trained in its use. It is, however, unclear if they have the relevant background to fully operate regional transport models, such as MATCH. Also, they will probably not have the time to delve into all aspects of modelling. Different ways to build this capacity to actually use the model have been discussed with UNEP. For example, one person could be assigned to work full-time with the MATCH model. The person could be a Ph.D. student. The person should have a particular task to solve with the MATCH model. A few persons at the emissions/modelling workshop have shown considerable interest in utilizing the MATCH model.

Recommendations for improvements: Measured ozone data for South Asia is in extreme shortage. In particular, day/night measurements at rural locations probably exist at less than 5 sites in the whole region. Measured data are needed to directly assess the levels of ozone in South Asia and also to test and verify the models operating in the region. The plans for the Malé monitoring stations only relate to the collection of monthly mean ozone concentrations.

The development of the IIAS could continue to rely on technical input and checking from SEI and SMHI and others, but the project would benefit in the long-term from increased capacity with specific air pollution scientific knowledge, either at UNEP in developing the IIAS, or in the new country-based topic-centre structure proposed.

Many NIAs do not realise how complicated the operation of a state-of-the-art atmospheric transport model often is. Many NIAs have unrealistically high expectations on the quality of the modelling results, the simplicity of operation of a model, the time it takes to complete a model simulation, how very critical the results depend on the input data, how easy it is to introduce new features in the model. Most models are developed for mid-latitude (Europe, North America) conditions, there is often a (too big?) suspicion that the models will not work perfectly under tropical conditions. The participants at the training workshops have asked for more hands-on exercises with the MATCH model.

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5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

The modelling results have been shared with the Malé sub-activity 4.2.1 ("crop-yield effects").

The MATCH model is compared with other modelling studies in East and Southeast Asia through the MICS-Asia project (co-ordinated by EANET). About 5 publications are currently underway that compare models operating in Asia (including MATCH).

6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

The current functionality of the IIAS is being upgraded and a launch and distribution to NIAs is planned for late summer. Further aspects relating to ozone and particulate matter will be included by the end of Phase III. This relies on running the MATCH model and being able to derive the methods to meaningfully estimate impacts with this regional scale modelling (i.e. health impacts are caused by pollutants resulting from a combination of regional and local emissions and we must be clear what the concentrations at 1x1 degree represent and therefore what a health impact derived from these concentrations mean).

The scenario and policy tool will be linked to the emission inventory for a few key sectors.

SMHI will start working on PM modelling.

A third training workshop is being planned to be held in Bangkok in early 2008. The training will include hands-on MATCH training (maybe only for a smaller group) as well as interrogation of the upgraded IIAS.

LFA 3.4 Develop Urban Integrated assessment

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 3.4 Develop Urban Integrated assessment	**Project Number:** 730 345
Lead institution: UNEP RRC.AP IVL (technical support)	**Prepared by:** UNEP RRC.AP with input from IVL
Collaborating Institutions: (name; principal contact; contact details) NIAs; Representatives of candidate cities (with IVL)	

Assessment and analysis of progress:

1. Outline of original project

1.1 Outline of original project: to develop capacity within the Malé Declaration countries for the quantification of emissions and pollutant concentrations and link this to health effects through comparison of population exposure to outdoor air pollution, and the geographic delineation of this

exposure, and comparison to dose-response relationships. This work will be based on the development of a spatially distributed emission inventory using relatively rapid techniques tested in Phase II.

2. Describe any deviation from original plan(s) and budget (with reference to current financial statement)

The RUA training took place in November 2006 instead of in July 2006 as initially planned, but this will not have any negative impact on completing the training program. Due to discussions about the measurement program, the first mapping campaign has been somewhat delayed. However, one year of monitoring will be performed within Phase III.

3. Results, outcomes and deliverables

A MoU had been signed with Nepal NIA to work on the case-study city for the development of urban integrated assessment RUA study. A manual for emission inventory preparation has been sent to the NIA, and their initial survey is on-going. At the meeting in Thimphu, a preliminary plan for the air quality monitoring programme was discussed, taking into account on-going monitoring activities in Kathmandu. The training on RUA took place at ICIMOD in Kathmandu in late November 2006. Staff from IVL were responsible for the five-day long training, in which 13 local experts participated. Most of the data required for applying RUA in Kathmandu had been collected by local staff before the training and, during the week, additional local emission data as well as geographical data were collected. Some data collection (e.g. traffic counts) was planned to take place after the week of training. The RUA method was demonstrated and adapted to local conditions. A revised manual was delivered to ICIMOD after the training on RUA in November 2006. Also, a separate report was delivered in which the activities carried out during the week were listed.

4. Assessment and analysis of progress:

The local partner for the RUA training was highly educated and skilled in GIS modelling. Implementation of activities was efficiently performed and cooperation between local partners worked well.

5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

During the preparations for the training, discussions between IVL and Kimab (previously the Corrosion institute) were frequent and the initial plan was to coordinate the RUA training with the corrosion study during the same week. However, this could not take place due to conflicting schedules.

6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

The first mapping campaign will start in April-May 2007. A second campaign is planned for November-December 2007.

LFA 4.1 Strengthen knowledge on human health

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 4.1 Strengthen knowledge on human health	**Project Number:** 730 415
Lead institution: UNEP RRC.AP (project leader) SEI and Murdoch University (technical support)	**Prepared by:** UNEP RRC.AP
Collaborating Institutions: (name; principal contact; contact details) NIAs Nominated health experts from Bangladesh Epidemiologist; Nurse; Technician	

Assessment and analysis of progress:

1. Outline of original project

The aim of this activity is to develop capacity within NIAs of the Malé Declaration countries to assess the impacts of air pollutants such as particulate matter and ozone on human health. Training will be provided in the assessment of impacts of air pollution on health, and wider societal impacts, using concentration data and dose-response relationships. The study will develop a network of health professionals and through this network the different available methods for health impact assessment will be discussed at the workshops and applied, thus learning by doing.

2. Describe any deviation from original plan(s) and budget (with reference to current financial statement)

The first Health workshop was held during 19-22 February 2007 but there has been a request of an additional workshop in October 2007. The original budget covered only one workshop.

3. Results, outcomes and deliverables

A MoU has been signed by Bangladesh NIA to work on a health impact study in Dhaka. The title of the project is "Assessment of impact of air pollution among school children in selected schools of Dhaka city" and the implementation period will be 18 months. Three schools had been selected in the central part of Dhaka city, which is subjected to high level of air particulate and all student of class VI. VII. & VIII (around 2000) will be included in the study. The proposal is guided by Prof. Frank Murray from Murdoch University and he visited Dhaka during January 2007 for a survey. Bangladesh NIA inform us that there was training for School Teachers / Technicians on questionnaire survey techniques and use of a Peak Flow Meter which was held on 20 January 2007 at the seminar room of NIPSOM. As per project design, they invited class teachers of VI to VII (morning shift) and one extra from all 3 schools. That means 7 teachers from each school were invited and it was attended by all of them.

Pakistan expressed their interest in participating in the health impact study during a meeting in Thimphu Bhutan in Sept 2006. Discussion between UNEP, SEI and Murdoch University regarding their request is on-going.

The first training workshop on Health Impacts was held in Bangkok during 19 to 22 February 2007. Eleven participants from six countries attended the training workshop. They were drawn from the Government agencies dealing with environment and with health issues. The report is available at http://www.rrcap.unep.org/md/malereport/.

4. Assessment and analysis of progress:

B. Specific information relating to your RAPIDC activity:

(i) How is the regional approach advancing the issue in the region? – what capacity is being built up and how does this relate to existing capacity?

The major reason that governments address air pollution issues is due to concern about effects of air pollution on human health. In the large and rapidly growing cities of South Asia there is evidence that current levels of air pollution are having significant impacts on health, especially due to current concentrations of particulates, and these levels are expected to increase in many cities as they continue to grow in population, industrial production, transport and energy use. However there is limited capacity in the South Asia region to assess these impacts.

The RAPIDC Male Activity 4.1.1 Assessment of health impacts has:

5. brought together regional expertise from Bangladesh, Bhutan, Iran, Maldives, Nepal, Sri Lanka and Thailand and provided the first of two training courses and materials to the participants in simple methodologies in assessment of impacts of air pollution on health
6. Commenced collation of regional information provided by the participants on studies conducted in their countries. This will be completed during this project.
7. Discussed the regional issues, sources, ambient concentrations, control policies, impacts on health and implications for the region.
8. Discussed the information needs of decision-makers in the region, how the information can be obtained, methodologies, resources, and regional collaboration to provide the information required.

The RAPIDC Male Activity 4.1.2 Measuring health effects has:

i. Completed the design phase and inter-agency coordination in Bangladesh.

ii. Almost completed the questionnaire phase involving recruiting schools, teachers and pupils, design and field-testing of the questionnaire in Dhaka, the distribution, collection, analysis and results reporting of about 1800 questionnaires, and the recruitment of pupils for the main phase.

iii. Commenced the main phase involving the daily testing of respiratory health of about 110 asthmatic pupils and about 60 non-asthmatic (control) pupils and the simultaneous monitoring of PM_{10} concentrations and meteorological conditions in Dhaka. The first week of a six-week long exercise has been completed. After schools re-open on 9 April, the remaining five weeks will be completed.

iv. The reporting phase is yet to commence.

(ii) significance of the project and its progress

The significance of the project is that it directly addresses many of the key issues for policy-makers concerning air pollution. It addresses: Why should we take action to reduce emissions? What do we

know about impacts on health in my country? Can we quantify adverse impacts of air pollution on health in my country? By strengthening knowledge and skills among key government officers about effects of air pollution on health, and by building partnerships among similar officials in the region, progress on implementing actions to reduce the adverse impacts of air pollution on health is being catalysed.

(i) a paragraph on your project that you might put in a press release;

More than half of the world's population now live in cities. In South Asia, the economic expansions in the large and rapidly growing cities are resulting in increasing levels of air pollution and threats to the health of urban residents. The dynamic developments of the cities of South Asia and their rapid economic transformations have resulted in a metamorphosis of the largest cities. The cities of South Asia are acting as magnets for poor rural people fleeing the hardships of poverty in villages for the new economic opportunities of the region's largest cities. With rapidly increasing economic growth, industrialisation, energy use and transportation, emissions of many air pollutants are increasing and growing numbers of people are exposed to higher levels of air pollution in many of South Asia's cities. At a time when policies implemented in developed nations are resulting in decreases in exposure to air pollutants, the opposite is occurring in many burgeoning cities of the region.

The World Health Organization estimates that two million premature deaths every year are caused by air pollution, mostly in developing countries. Recent decades have seen major advances in knowledge about air pollution, its effects on health, the evolution of international air pollution guidelines, and the emergence of innovative policy instruments and management approaches to air pollution prevention and control. There is an obvious gap in knowledge about the effects of air pollution on health in the cities of South Asia. The UNEP RRC AP and the Stockholm Environment Institute are combining their efforts to build knowledge about the impacts of air pollution on health in the cities of South Asia in a project supported by the Swedish International Development Cooperation Agency. They have brought together experts from Bangladesh, Bhutan, Iran, Maldives, Nepal, Sri Lanka and Thailand to conduct workshops on the impacts of air pollution on health in South Asia. The results of these studies will be presented to government representatives from the countries in South Asia in a policy dialogue to be held later this year.

(ii) a summary of substantive progress;

Experts from Bangladesh, Bhutan, Iran, Maldives, Nepal, Sri Lanka and Thailand have participated in the first of two training courses and received materials in the use of simple methodologies to assess impacts of air pollution on health. These experts have collected and discussed those studies conducted in South Asian region on impacts of air pollution on health. They have also discussed the information needs of decision-makers in the region, how the information can be obtained, methodologies, resources, and regional collaboration to provide the information required. The high level of satisfaction with the progress was demonstrated by the results of exit questionnaires completed by participants. For example, of the twelve participants, seven rated it as excellent and five as good. The participants especially liked the interaction among participants, networking, sharing of information and collaboration, sharing of information about study designs and the friendly atmosphere of the workshops, the SIM Air model, good time management, CDs of information provided, informative presentations, right mix of presentations and discussion, the depth of information, friendly environment and effective teaching

(iii) any interaction with the region in terms of help 'in kind' and financial assistance;

As a direct result of these workshops, experts offered to assist other countries in South Asia with studies to gather the information on effects of air pollution on health by providing advice and in-kind support.

(iv) progress on capacity building and ownership detailing prospects for sustainability of built capacity;

Substantial strengthening of capacity occurred, although it varied with the level of existing capacity. Some of the countries were at low capacity and considerable capacity building was possible. In particular, the development of regional awareness and cooperation was a significant achievement.

5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

Linkages to other RAPIDC projects assisted this project such as the synergies with projects to develop emissions inventories and monitoring methodologies.

6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

After the completion of this activity, the next stage is for the design and implementation of appropriate studies to support a regional assessment of impacts of air pollution on health in South Asia with regional ownership and commitment of resources. Agreement on regional priorities, study designs, a framework for assessment and assessment methodologies is required. Support would also be required to enable some countries to participate and benefit from the assessment.

7. Gender, poverty and HIV/Aids issues relevant to project

There is a well-demonstrated relationship between ill-health and poverty. The poorest people in developing countries are usually exposed to the highest levels of air pollution, living or working close to industry or major roads. Due to poverty they are forced to use cheap biomass fuels for cooking and heating, and consequentially they suffer the most serious health impacts of air pollution, and have poor access to health services. Women and children are especially vulnerable to indoor air pollution from cooking and heating, or selling goods to drivers and pedestrians along major roads. The raising of awareness within governments about the impacts of air pollution on health and suitable measures to address these impacts will provide the greatest benefit for women, children and the poor.

LFA 4.2 Strengthen knowledge on crops

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 4.2 Strengthen knowledge on crops	**Project Number:** 730 425
Lead institution: UNEP with support from SEI	**Prepared by:** UNEP RRC.AP with input from Lisa Emberson, Patrick Buker, Madhoolika Agrawal, Dr. Hakan Pleijel and SMHI
Collaborating Institutions: (name; principal contact; contact details) UNEP Regional Resource Centre for Asia and the Pacific (RRC.AP), Thailand (Iyngara Mylvakanam); NIAs; Stockholm Environment Institute at York (SEI), York, UK (Dr. Lisa Emberson, Patrick Büker); Banaras Hindu University (BHU), Varanasi, India (Prof. Madhoolika Agrawal); Gothenburg University, Gothenburg, Sweden (Dr. Håkan Pleijel); Swedish Meteorological and Hydrological Institute, Norrköping, Sweden (Dr. Magnuz Engardt)	

Assessment and analysis of progress:

1. Outline of original project

The main objectives of this project are to develop and apply methods to:

i) assess the geographical extent of risk to crops from air pollution

ii) demonstrate the occurrence of crop impacts in the geographical regions.

2. Describe any deviation from original plan(s) and budget (with reference to current financial statement)

The project has been delayed due to two main problems: i) The propagation of the clover-clone bio-indicator plants has proved problematic in parts of South Asia (Bangladesh and Sri Lanka), plants have now been successfully established in Bangladesh and Pakistan. ii) We still have not obtained a plant import permit for clover cuttings in India.

The propagation problems are likely due to the long transport time of the plant cuttings (shipment from Europe to Asia via express courier) and unfavourable site-specific climatic conditions. To date, two batches of clover plants have been sent to Bangladesh, Pakistan and Sri Lanka, but all plants died with the exception of the second batch of clover sent to Pakistan. Since Pakistan (Lahore) managed to establish the plants and the experiment, this site may function as the regional supply centre of clover cuttings for all other South Asian countries involved. New cuttings will be sent from Lahore to Sri Lanka as soon as the stock plants have been fully established and to Nepal in September 2007, whereas Bangladesh will be personally supplied with clover cuttings by Patrick Bueker during his training trip to Bangladesh in mid April 2007.

India could also be supplied with cuttings from Pakistan, however despite several attempts of high-level bilateral negotiations, a plant import permit for clover cuttings has yet to be issued by Indian officials.

Additional funds have been made available to pay for the repeated shipment of cuttings, and will be made available for the propagation and shipping of stock plants in/from Lahore.

The project is coordinated by the Malé Declaration Secretariat in the region. Patrick Bueker of SEI has been undertaking this role that has involved combined trips to Sri Lanka and Nepal as well as one trip to Bangladesh to advise participants in the set up of the experiments. Funds have been made available from the contingency budget for this additional effort.

3. Results, outcomes and deliverables

The **Provisional risk assessment.** A provisional risk assessment has been performed for South Asia using the MATCH model (Engardt, pers. comm..). Three month AOT40 values at 3 m above surface during three different periods were modelled for the year 2000. The results show that during the September to October period, which is the main growing season for many crops in South Asia, exceedance of the European critical level for wheat occurs over large parts of India, as well as north eastern Pakistan, much of Bangladesh and a large swathe of the Tibetan plateau (Fig. 1). Adverse

impacts of surface O_3 on agriculture might therefore be expected with the potential for yield losses in the region of up to 30%, assuming applicability of European derived air quality guidelines.

The **bio-monitoring campaign.** A key achievement of this project has been to establish a bio-monitoring network under the Malé Declaration. This network comprises 5 countries Bangladesh, India (not actively involved at the moment due to the pending import permit), Nepal, Pakistan and Sri Lanka. Due to the experience of these network members it was deemed appropriate for them to carry out the protocol without prior training. Technical support via e-mail and phone has been provided throughout the entire duration of the first year of the bio-monitoring campaign. Due to the problems in obtaining a plant import permit for India and also in establishment of clover cuttings at all sites except for Pakistan, the current Pakistan study will act as the pilot for this study for the Malé region. A first training workshop to discuss preliminary results and problems will be held in Dhaka/Mymensingh (Bangladesh) in mid August 2007.

The chemical protectant study. was piloted in 2006 in Varanasi (India). This study used mung bean (*Vigna radiata* L.) as a bio-indicator since this species is known to be O_3-sensitive and of economic importance in South Asia. The results show that the ozone concentrations in Varanasi were high enough to substantially reduce the number and weight of seeds and pods, the leaf area and the total plant length of mung bean, and that EDU can effectively protect mung bean from these ozone-induced impacts (Fig. 2). This experiment will be extended to Pakistan for the 2007/08 growing season. Additional species and varieties of potato, spinach and tobacco will also be assessed for their suitability for use with this experimental technique.

Since the production of EDU is very expensive, only two Asian sites will carry out the experiment during this funding phase of RAPIDC. The production of EDU is now possible in Potchefstroom, South Africa (at a lower cost than in the UK). Sri Lanka has expressed its strong interest in carrying out the EDU study in combination with a filtration study (OTC), in addition Sri Lanka may be able to act as the south Asian regional supply centre for EDU.

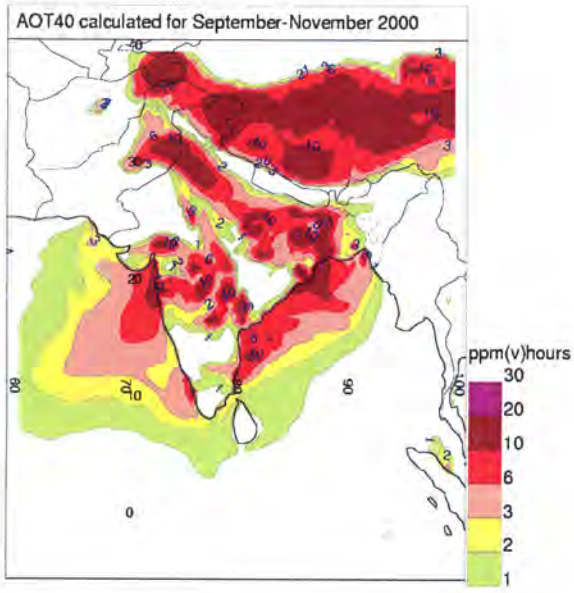

Fig. 1. Three month (September to November 2000) AOT40 simulations calculated using the MATCH model (Engardt, pers.comm.).

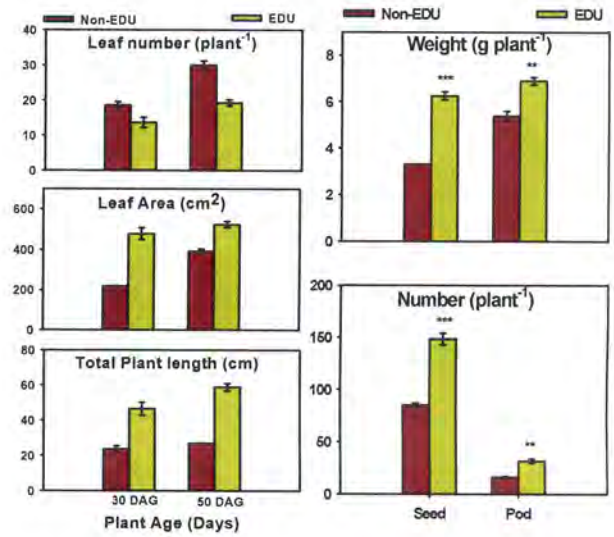

Fig. 2 EDU effect on mung bean plants exposed to ambient in Varanasi (India) in 2006

A synthesis of the entire RAPIDC crops project, both including this and previous phases, has been described in a book chapter currently in press (Emberson et al., in press). This summary provides more detail as to how the different components of the Crop work (APINA, Malé and APCEN) combine together and complement research to assess crop impacts in the two specific regions and connect with ongoing research globally. Research focussing on the importance of the impact of air pollution in comparison with the impact of other environmental stresses (e.g. drought) on crop growth will become more important under the influence of climate change and show the innovation of this RAPIDC initiative carried out in South Asia under current day conditions.

Reference list (those in bold are publications arising from the RAPIDC crops project)

Emberson, L.D., Ashmore, M., Murray, F. (2003): Air pollution impacts on crops and forests. A global assessment. Imperial College Press, London.

Emberson, L.D., Büker, P., Engardt, M., van Tienhoven, A.M, Agrawal, M., Zunckel, M., Hicks, K., Pleijel, H. Assessing air pollution impacts to agriculture: A framework methodology for assessing the risks caused by ground-level ozone (O_3) in South Asia and southern Africa. In: Pal, A. (Ed.), ASEAN - Environmental Perspectives, in press.

4. Assessment and analysis of progress:

***A. General information and context concerning the issue being addressed by the RAPIDC activity*:**

(i) What is the status of the issue in the relevant region? There is a strong evidence base to show that ambient ozone concentrations are at high enough levels to be causing significant damage to agricultural crops in the south Asian region (e.g. Emberson et al., in press). However, the studies that provide this evidence have not been conducted in a co-ordinated fashion. There is an urgent need to perform co-ordinated standardised experimental studies to provide dose-response data from across the region that can be pooled to produce specific dose-response relationships for use in regional scale risk assessments.

The awareness of the issue is high amongst the scientific community; it is the engagement of policy makers that is proving a little more difficult. The Malé crops activity has focussed on raising awareness through publications and presentations at different conferences / meetings / workshops during the course of the three project phases of the RAPIDC project, (e.g. the 3rd ICPEP conference in Lucknow (India)).

(ii) What are the capacity enhancement and assessment needs – institutions, activities and personnel and the importance of data quality etc? The existing capacity in the region is high with many experienced scientists having access to experimental facilities appropriate for the evaluation of air pollution impact assessments especially in India, Pakistan and Sri Lanka. The current project is helping to build links, via the bio-monitoring campaign, between these experts and scientists in the other south Asian countries where expertise in air pollution research is much lower.

(iii) Are there major trends for the issue in the region(s) that you can identify? None evident as yet.

(iv) For impacts, what are the prospects and progress of mitigation in the region(s)? Policy makers should be involved as soon as possible in the process of defining an appropriate presentation of science based evidence that will drive the need for policy interventions. These should be formulated on consideration of all air pollution impacts (especially health impacts) to develop mitigation options that optimise benefits for all impacted sectors.

(v) The significance of the regional approach – needs, advantages, data exchange, personal – professional linkages etc. A regional approach to this issue would be extremely important since surface ozone is a transboundary pollutant. As such, the implementation of any future mitigation strategies that may be required can only be managed by a joint approach of all Malé countries.

B. Specific information relating to your RAPIDC activity:

A bio-monitoring network has been established in South Asia, in the following Malé Declaration countries: Bangladesh, India, Nepal, Pakistan and Sri Lanka. Crop effect scientists have been identified in all five countries and have agreed to carry out the clover-clone bio-monitoring experiment during the 2007/08 growing season according to a standardised protocol without prior training. All countries apart from Nepal, who opted for a later start of the experiment due to its specific climate, have tried to establish the clover-clone experiment, with different levels of success. Establishing Pakistan as regional supply centre will hopefully solve problems associated with the long transport time of clover cuttings from Europe.

Capacity will be further increased through the first training workshop scheduled for mid August 2007 in Dhaka/Mymensingh (Bangladesh). Scientists representing all Malé Declaration countries will be trained in assessing the impacts of air pollutants on crops with a special focus on bio-monitoring and chemical protectant methods.

C.

(i) Press release; There now exists substantial evidence that surface ozone occurring at levels high enough to cause substantial damage to crops in south Asia. However, there have to date been no co-ordinated assessments of the impacts to key crops and crop varieties of the region that would allow accurate estimates of the actual yield losses to be quantified and expressed in socio-economic loss terms. This is a large gap in knowledge, especially given the large projected increases in surface ozone concentration projected over the next 20 to 30 years in this region. The Malé crops activity is taking a leading role to capacity build expertise across the region that in the near future should enable assessments of the real impacts of surface ozone to key agricultural crops across the region, this information will be crucial for future estimates of food availability and food security of the more vulnerable sectors of society.

(ii) a summary of substantive progress; (see above)

(iii) any interaction with the region in terms of help 'in kind' and financial assistance; Sri Lanka has expressed its interest in carrying out further air pollution impact assessment studies using EDU and Open Top Chambers and seems to be willing to find own funds for this

(iv) progress on capacity building and ownership detailing prospects for sustainability of built capacity; it is hoped that Lahore, Pakistan can become the regional focus for the propagation of clover-clone plants and supply cuttings to the other Malé countries. It is also hoped that Sri Lanka can manufacture EDU and supply this chemical to participating network members.

(v) major problems/ set backs; Difficulties in establishing clover plants due to transport and climatic conditions have led to a substantial delay of the bio-monitoring campaign in all countries; the lack of a plant import permit for India has delayed, and in fact now jeopardised the performance of this experiment at the site in Varanasi.

(vi) recommendations for improvements; The clover bio-monitoring as well as the EDU study should be carried out for a couple of consecutive years to provide a large enough data base of results to inform the provisional risk assessments, i.e. securing further funding is very important.

5. Linkages within the RAPIDC Programme The project has links with the following bodies:-

- ICP Vegetation and UNECE CLRTAP (bio-monitoring)
- RAPIDC APINA links (bio-monitoring)
- UNECE CLRTAP (use of critical levels in provisional risk assessment)
- APCEN Network (providing support and technical advice for risk assessment and bio-monitoring)

6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

The clover bio-monitoring experiment will be carried out in all countries during the 2007/08 growing season but ideally would be continued for additional future years as we have really only now established the network. The site in Pakistan would ideally take on the role of a regional technical support centre for the clover-clone bio-monitoring study; the site in Sri Lanka would ideally perform the EDU experiment and also manufacture EDU for provision to other south Asian countries.

LFA 4.3 Strengthen knowledge on corrosion

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 4.3 Strengthen knowledge on corrosion	**Project Number:** 730435
Lead institution: UNEP with technical support from Corrosion and Metals Research Institute (KIMAB)	**Prepared by:** UNEP RRC.AP with input from Corrosion and Metals Research Institute (KIMAB)
Collaborating Institutions: (name; principal contact; contact details) NIAs Institutions nominated to undertake exposures and other activities Please see input from SCI	

Assessment and analysis of progress:

1. Outline of original project

The aim of this activity is to develop capacity within Malé Declaration countries to assess the impact of air pollutants on materials and objects of cultural heritage. The main activities are to strengthen knowledge of the impacts of air pollution on corrosion, assess corrosion at sites, demonstrate corrosion risks and training in stock at risk

2. Deviation from original plan(s) and budget

For the assessment of corrosion at sites, there has been a request for new sites from Bangladesh and Maldives not covered by the original budget.

Related to CORNET sub-activity: there has been a request to hold an additional workshop and training, in the beginning of 2008, on evaluation and interpretation of results.

3. Results, outcomes and deliverables

Malé Declaration program and CORNET (Corrosion Network program) jointly organized a training workshop on evaluation of corrosion attack on material during 9-10 October 2006 at UNEP RRCAP,

Bangkok, Thailand. On 11th October, the workshop was followed by a meeting of CORNET (Corrosion Network). There were 30 participants in the workshop: 9 from Malé Declaration countries (Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan, Sri Lanka), 9 from CORNET countries (Hong Kong, Vietnam, China, Malaysia, Thailand), 5 from APINA network, African countries (Mozambique, Tanjania, Zimbawe, Zambia) and others from collaborating institutions; Corrosion and Metals Research Institute (KiMab) and UNEP RRC.AP.

The workshop aimed at capacity building in 8 Malé Declaration countries and other participating countries for studying the evaluation of corrosion of acid deposition on various materials and consequently enabling them to design science-based policy options to mitigate air pollution and its adverse effects on materials. Thus, the workshop was designed to provide the basic theoretical concepts and a technical hands-on training to the participants on simulation as well as evaluation of corrosion attacks of acid deposition on a wide range of materials, ranging from zinc and carbon steel to the stones that resemble those used in making sculptures and monuments. Detail of the report will be available on http://www.rrcap.unep.org/md/Maléreport/

Four new test sites were established and exposure started in the fall of 2006 with planned withdrawal of specimens in the fall of 2007 (Kathmandu, Nepal; Agra, India; Battaramulla, Sri Lanka; Teheran, Iran).

Ten corrosion kits were erected in Kathmandu, Nepal in the fall of 2006 with planned withdrawal of specimens in the fall of 2007.

The evaluation of trend results are on-going and partly completed.

4. Assessment and analysis of progress:

Corrosion is considered as one of the important impacts of air pollution. The current level of understanding on the highest educated level is that acidifying pollutants, mainly SO_2 is a large contributor to the observed corrosion levels. What is not known is to what extent and how the different climatic conditions compared to Europe affects the relative importance of the effects of local and long-distance transported pollutants. On a lower education level and by the population in general corrosion is considered a problem but is not linked to air pollution.

Suggestion for press release;

Air pollution destroys buildings and cultural heritage in developing countries.

Poor people in developing countries not only suffer from health problems but also have to deal with leaking roofs and the fact that their precious national heritage symbols crumble before their eyes. All this is due to air pollution, which has increased dramatically in recent years because of increased transportation and energy use. The problem is addressed in a Sida financed project on corrosion impacts in developing countries. The project has established a corrosion network (CORNET) with a growing number of participants from Asia and Africa who together provide knowledge to policy makers for reducing pollution in a cost-effective way.

Summary of substantive progress;

The corrosion network (CORNET) has grown from 12 test sites in Asia and 4 test sites in Africa to 16 test sites in Asia and 6 test sites in Africa. All these partners and potential new partners met at the workshop on sample evaluation held in Bangkok, Thailand, 9-11 October 2006.

Capacity building and recommendations for improvement

The workshop on sample evaluation was specifically designed to build capacity and is now followed up by analyses in individual countries. There is a significant variation in capacity level – not between regions (Asia-Africa) but from country to country. Some countries / partners are still struggling to carry out the basic tasks of exposing specimens while other countries / partners are close to the level of taking over as a sub-centre for evaluation of corrosion attack for a single material or group of materials. More training is needed, on both a very basic level, but also more advanced training for selected partners.

5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

The close link established between collaborating partners in Asia and Africa within CORNET has been considered very useful from the aspect of sharing personal experiences and solutions but also by sharing data. Future proposals and activities from Male and APINA needs to be co-ordinated to ensure that this good co-operation continues in future phases of RAPIDC.

It is also recommended that closer links between activities in Europe / CLRTAP networks and other regions of the world should be established.

6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

Malé

4.3 Strengthen knowledge on the impacts of air pollution on corrosion

4.3.1 Assess corrosion at sites

- Withdrawal and analysis of corrosion attack on the four new test sites
- Two new test sites in Bangladesh and Maldives (if funds available)

4.3.2 Demonstrate corrosion risks

- Withdrawal and analysis of corrosion attack for the ten kits exposed in Kathmandu

4.3.3 Training in stock at risk

- training in stock at risk and cost estimation in Kathmandu, Nepal

CORNET

1.1 Corrosion Network (CORNET) development and capacity building

1.1.1 Hold workshop and training

- workshop on evaluation and interpretation of results beginning 2008 (if funds available)

1.2.1 Collection of relevant data

- evaluation of dose-response functions

1.2.2 Trend exposure

- establishment of trends in corrosion and pollution and comparison of samples evaluated in individual countries to those evaluated in KIMAB.

General

For the next phase of the programme, and in order to achieve a sustainable network, it is necessary to appoint sub-centre(s) in the two regions that can take on a leading role. The Malé Declaration network and APINA should be responsible for the appointments, in consultation with KIMAB if found

appropriate. Several criteria need to be considered taking into account technical and political considerations.

LFA 4.4 Strengthen knowledge on acidification

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 4.4 Strengthen knowledge on acidification	**Project Number:** 730445
Lead institution: UNEP with support from SEI	**Prepared by:** SEI and UNEP RRC-AP
Collaborating Institutions: (name; principal contact; contact details) NIAs: Nominated soil institutes	

Assessment and analysis of progress:

1. Outline of original project

The aim of this activity is to develop capacity within the Malé Declaration countries to assess the potential for soil acidification and subsequent ecosystem impacts. This knowledge can then be used in conjunction with the Integrated Assessment Model activity of the Malé Declaration. This work will involve the use of Malé Declaration Acidification assessment manual which was developed in the previous phase.

2. Describe any deviation from original plan(s) and budget (with reference to current financial statement)

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3. Results, outcomes and deliverables

The main activity period will surround the workshop to be held in conjunction with the last Malé emission inventory workshop in phase III, scheduled for early Spring 2008. To date SEI and UNEP have been consulting NIAs regarding suitable ecologists/ soil scientists to attend the training, who can bring available data from each country to apply the simple risk assessment methods using.

4. Assessment and analysis of progress:

The use of the SEI assessment methods for soil sensitivity to acidic inputs and time development of acidification damage using country specific data should start to finally provide meaningful insight into the potential for acidification of soils and waters in the region. This information will then be fed into the Malé Declaration Integrated Information and Assessment System (IIAS).

5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

See above.

6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

Workshop in early spring 2008.

LFA 5 Decision Making Support for Prevention and Control of Air Pollution

These are three related projects that are essentially being planned together and where, in practice, there has proved to be significant overlap in some cases.

LFA 5.1 Support for policy formulation for mitigation

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 5.1 Support for policy formulation for mitigation	**Project Number:** 730 515
Lead institution: UNEP with support from IIIEE	**Prepared by:** UNEP RRC.AP with input from IIIEE
Collaborating Institutions: (name; principal contact; contact details) SEI, IIIEE; NIAs; Technical advisors	

LFA 5.2 Case studies in practical options to reduce air pollution

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 5.2 Case studies in practical options to reduce air pollution	**Project Number:** 730 515
Lead institution: UNEP with support from IIIEE	**Prepared by:** UNEP RRC.AP with input from IIIEE
Collaborating Institutions: (name; principal contact; contact details) SEI; NIAs , Technical advisors	

LFA 5.3 Sector based approaches to mitigation

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 5.3 Sector based approaches to mitigation	**Project Number:** 730 515
Lead institution: UNEP with support from IIIEE	**Prepared by:** UNEP RRC.AP with input from IIIEE
Collaborating Institutions: (name; principal contact; contact details) SEI, NIAs, Technical advisors	

Assessment and analysis of progress:

1. Outline of original project

The Malé Declaration Phase III is being implemented in 3 steps: 1) networking; 2) capacity building and 3) provide information for policy makers and stakeholders. This part of project will initiate the implementation of step 3. The activities will aim at development and dissemination of good practises for mitigation of air pollution for policies makers and stakeholders.

The three aims of the projects are:

i. to develop a policy guide for the Malé Countries

ii. to develop compendia of case studies for the different sectors and

iii. to develop a more detailed concerning the housing and transport sectors

2. Describe any deviation from original plan(s) and budget (with reference to current financial statement)

Essentially the different projects within Malé Result 5 are being implemented as one project as it turns out that there is considerable overlap between the aims of the different projects and it is very difficult to separate policies from case studies.

3. Results, outcomes and deliverables

The main outcome thus far has been in the development of the manual containing international case studies for policy interventions for air pollution prevention and control in the context of a meaningful structure. The appendix to this manual comprises the sector based case studies that are the deliverable for 5.3. This has been a background document for the other main outcome which has been delivery the training and capacity building of the country representatives at two separate meetings.

Policy case study manual by IIIEE: a preliminary first draft of the *Policy Options for Air Pollution Prevention and Control in South Asia* was developed and distributed to the all participants during the first training session held 5-6 July 2006 at UNEP RRCAP, Bangkok, Thailand. A questionnaire addressing training content and future needs for training in air pollution policies was developed and filled in by participants to help guide the second training workshop. A second draft of the policy case study manual by IIIEE was then presented during the second training workshop in February 2007 (which was held back-to-back with the Malé Declaration emission inventory preparation/ scenarios/ atmospheric transport modelling workshops).

The policy case book which addresses the aim to "Provide decision support information" has been essentially completed and this task will also contribute significantly to the development of a scenarios front end to the workbook and development of capacity in Emission Scenario Development.

Further development of this project will be implemented through the **involvement of Prof. Ram Shrestha from AIT**. Discussion with Prof. Shrestha has resulted in a TOR for him to prepare further technical input for decision support information for policy formulation and air pollution prevention specific to South Asia. This will then complement the international best practice information compiled by IIIEE. The main output will be 1) a compendium of best practice in preventing and controlling air pollution in South Asia and 2) a report on strategies to implement and upscale the identified best practices in South Asia.

In addition, an analysis of the factors which influence the success of different policies in South Asia, barriers to implementation and how they have been overcome will form a further part of this activity. This work will be coordinated with help from SEI who plan to employ a specialist in this area, who has experience of analysis across Asia, in order to undertake this project in coordination with IIIEE and AIT.

Beyond the overview of options in the different emitting sectors, there is specific emphasis on the housing and transport sectors. For the transport sector, IIIEE has developed most of the information in relation to the good practice guide specified above and will further develop this as a part of the good practice guide for the housing and transport sectors. There are two components to the housing sector projects – the promotion of eco-housing in Asia, which is in progress, and the development of a compendium of international good practice in the housing sector of relevance to the Malé countries which will be produced by IIIEE in late summer 2007. Progress on the eco-housing project is described in the following paragraphs.

Consultation for the eco-housing project in Maldives, 10-12 September 2006, Bangkok. Two members of the Maldives design team, drawn from the Ministry of Energy, Environment and Water and from the Ministry of Construction and Public Infrastructure, visited the Regional Expert Group members in Bangkok during 10-12 September 2006. The aim was to get guidance regarding the preliminary design of the eco-building in Hanimaadhoo island. The meetings were held at UNEP RRCAP and the Bio-solar house in Pathumthani. The Regional Expert Group members from Chulalongkorn University and the Asian Institution of Technology, served as resource persons. The experts suggested changes to the orientation and layout, landscaping, ventilation, day lighting, the design of the roof, building materials, type of masonry, space utilization, and on roof space cooling. After consultation, the team work on revising the design and cost estimates.

Workshop on the eco-housing project in Bhutan, 14 September 2006, Thimphu. A design review workshop was held in Thimphu, Bhutan, on 14th September 2006, regarding the eco-building being designed in Thimphu. The workshop was inaugurated by the Honorable Minister of Works and Human Settlement, Government of Bhutan. Mr. Surendra Shrestha, Regional Director of UNEP, gave the opening remarks. Presentations were then made on the design of the eco-building. Regional and national level perspectives were presented by experts from UNEP's Regional Expert Group followed by discussions. The workshop concluded by recommending further development of the proposed design.

4. Assessment and analysis of progress:

The policy case study manual provides an important compendium of the different policies that have been used internationally to prevent or control air pollution. These have been illustrated through two very innovative training sessions for the Malé representatives where they have been asked to analyse the suitability of policy interventions in relation to specific criteria. This process is building capacity in the ministries of environment in more optimal environmental policy development.

The sectoral assessments which have been highlighted in the case studies will also provide valuable insights into the incorporation of policy options in the IIAS and the linkage of policy options to the emission inventory workbook.

IIIEE will be developing a compendium of international best practice in the housing and transport sectors. This will also give information about the amount of energy saved by a few key measures, such as eco-housing, and so feed into the scenario development. Due to the vast amount of information available for both housing and transport sectors, IIIEE plan to produce a reading guide for

the Malé Declaration representatives structured in a useful way, rather than to try an summarise the information itself into a huge document that no-one will read.

Eco-housing is a drive to develop new buildings with a minimal requirement for energy, water and other resources. The development of Eco-housing in the region will reduce the usage of energy and therefore prevent emissions related to electricity production which is a major cause of air pollution. Capacity training programmes for local architects are now being regularly organized to develop the capacity of the national level development.

5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

The IIIEE work continues to draw extensively upon the work of existing air pollution initiatives in the region and internationally. Aspects of this project also have links, and overlap with, work within an Energy for Sustainable development training course being developed by the IIIEE in collaboration with Energy and Environment Group, Bureau for Development Policy within the United Nations Development Programme in New York (website: www.undp.org/energy) addressing topics such as gender issues, poverty issues, capacity building, technology introduction, policy formulation and so forth. Such synergies continue to be sought.

6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

Initial discussions have been held with Prof. Ram S. Shrestha from AIT concerning his preparation of a report on strategies to implement and upscale the identified best practices in South Asia. The report would describe strategies separately for each of the following emission source sectors: Energy Sector, Industrial Processes, Solvent and Other Product Use, Agriculture, Vegetation Fires & Forestry, Waste. The report would contain

- The penetration rates of the Best Practice in each sector
- The obstacles facing the uptake of the Best Practice, in each sector
- Strategies to promote the Best Practice in each sector

A MoU has been prepared based on the above activities and on-going discussions will link to the work that SEI will contribute in terms of analysing the factors in South Asia that affect the degree of success for the implementation of different policies.

Further development in these projects includes:

- Identification of an institution in Bangladesh to participate in Eco-Housing and develop ToR for Eco-Housing training for Bangladesh
- development of a reading guide for the housing and transportation sectors
- finalise the report on strategies for prevention and control in the different emitting sectors .

7. Gender, poverty and HIV/Aids issues relevant to project

Additional factors such as gender, poverty and HIV/aids are relevant in the context of air pollution – in particular indoor air pollution – in terms of exposure and reduced physical resistance of populations to health problems in general. It is natural that such links are reinforced in the work.

LFA 6.1 raising awareness through targeted dissemination

RAPIDC Annual Report	Period covered by report: (month/year to month/year) May 2006 – April 2007
Project Title: 6.1 raising awareness through targeted dissemination	Project Number: 730 615
Lead institution: UNEP RRC.AP Environmental journalist networks	Prepared by: UNEP RRC.AP
Collaborating Institutions: (name; principal contact; contact details) Environment-education specialists Policy advisors NIAs	

Assessment and analysis of progress:

1. Outline of original project

1.1 **Outline of original project:** To raise awareness about air pollution in South Asia for action through targeted dissemination, there will be activities to develop media packages on air pollution through publication of awareness materials, educational materials targeting primary schools, secondary schools, collages and universities and conduct regular lectures and consultation with senior government officials.

2. Describe any deviation from original plan(s) and budget (with reference to current financial statement)

This component is more focused on youth as the medium to raise awareness on air quality issues in South Asia. This component is also using the informal education as opposed the formal education process. Among the impacts of air pollution, health impacts are being used as the awareness tool as it is easily understood by politicians and general public.

3. Results, outcomes and deliverables

Contact has been established with the SAYEN Secretariat to develop awareness materials and multimedia packages targeting young people. The main activity is to develop a sub-regional Youth Action document on "Youth for Clean Air". This document will be the Malé Declaration: Youth Version and include but not limited to the major sources of air pollution, impacts of air pollution, mitigation and prevention measures and Malé Declaration and its contribution to the prevention of air pollution in South Asia. Based on the publication, SAYEN will develop an animated CD to be used by youth in the sub-region as resource and awareness materials on Clean Air.

UNEP has provided update on air pollution issues in Asia in general and Malé Declaration countries in particular for the following senior government officials:

- State Minister for Environment and Forest, India in August 2006
- Deputy Minister, National Environment Commission, Bhutan in September 2006 and April 2007
- Minister, Ministry of Environment and Natural Resources, Sri Lanka in December 2006
- Minister, Ministry of Environment, Energy and Water, Maldives in February 2007

- Minister, Ministry of Environment, Science and Technology in February 2007
- Minister, Ministry of Environment Pakistan, in March 2007

Publication: The Sixth Session of the Intergovernmental Meeting of the Malé Declaration requested the preparation of a publication focusing on the past, present, and future of the Malé Declaration. The Secretariat, with input from the regional facilitator, has completed the first draft of the publication for discussion and the Seventh Session of the Intergovernmental Meeting agreed on the draft. Upon publication in 2007, the document will promote awareness on air pollution and Malé Declaration. This publication will be a useful reference material for the academic institutions and researchers.

Newsletter and Brochure: A brochure on the Malé Declaration was published before the meeting in Bhutan on 12-13 September 2006 and some of the countries plan to translate it into their language for awareness purposes. The newsletter and brochure are distributed to all the members of UNEP Collaborative Assessment Network (CAN), which include generators and users of environmental data in Asia. The newsletter is also distributed through relevant meetings such as the meetings of the EANET, CAI-Asia, and Saltsjobaden III.

The Secretariat updated the Malé Declaration website by posting relevant information on Malé Declaration activities, such as training programmes, meeting documents, and the newsletter. Relevant scientific and technical information was disseminated among the participating countries as well as other countries, relevant organizations, and individuals.

National level awareness has also been initiated with the participation of national implementing agencies. A detailed work plan for the activities in Bangladesh has been developed. Specific activities will include:

- Development of public awareness material through drama, folk song and documentation on air pollution.
- Translation of Malé Declaration booklets to Bengali language
- Development of posters and stickers on the Malé Declaration for publicity

Health impact assessment studies are being conducted in primary schools in Bangladesh. The programme has been designed not only to collect data collection on health impact of air pollution, but also to promote awareness amongst the school children on the issue of air pollution.

4. Assessment and analysis of progress:

Activities on awareness rising have been progressing well. Some of the indicators of success of this component include:

- Member countries has become aware of the need for promoting Malé Declaration at the national level and developed national awareness programmes. This has been evident by the development of an extensive awareness programme by Bangladesh.
- Several non-participating institutions have approached the Secretariat to participate in the training programmes of the Malé Declaration.
- Representative from India identified Malé Declaration as a good example for regional cooperation during the BAQ 2006 workshop in Indonesia.

- Minister, Ministry of Environment, Science and Technology in February 2007
- Minister, Ministry of Environment Pakistan, in March 2007

Publication: The Sixth Session of the Intergovernmental Meeting of the Malé Declaration requested the preparation of a publication focusing on the past, present, and future of the Malé Declaration. The Secretariat, with input from the regional facilitator, has completed the first draft of the publication for discussion and the Seventh Session of the Intergovernmental Meeting agreed on the draft. Upon publication in 2007, the document will promote awareness on air pollution and Malé Declaration. This publication will be a useful reference material for the academic institutions and researchers.

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- Representative from India identified Malé Declaration as a good example for regional cooperation during the BAQ 2006 workshop in Indonesia.

A future phase of Malé Declaration could promote awareness activities at the national level. The templates that are beginning to be developed by Bangladesh could be applied in the other countries of the Malé Declaration.

5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

The programme is linked with all the components of RAPIDC programme and major regional initiatives as all the awareness materials are distributed during the major meetings and training programmes.

6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

The following activities are planned for the remaining part of Phase III:

- conduct the inception workshop for the Youth for Clean Air in May 2007
- publication of the past, present and future of the Malé Declaration
- complete an awareness package for youths on air pollution. This package will be made available for media for further dissemination.
- Conduct an awareness workshop to disseminate the multimedia package.
- Conduct an awareness-cum-consultation workshop on health impacts of air pollution in India
- Conduct public awareness programmes and a media campaign on the impacts of air pollution in Bangladesh.
- Development of a distribution data base for the Malé Declaration newsletter.
- A lecture on Malé Declaration is scheduled for June 2007 for high level government officials from Southeast and East Asian countries.

Appendix 4 Report from APINA activities

LFA 1.1: Strengthen stakeholder participation and national APINA structures

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 1.1 Strengthen stakeholder participation and national APINA structures	**Project Number:** 731115
Lead institutions: Ministries of Environment in the seven participating countries	**Prepared by:** RAPIDC Co-ordinators for APINA, Stephen Simukanga and Sara Feresu

Collaborating Institutions: (name; principal contact; contact details)

National Focal Points (NFPs) for this activity:

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APINA Country Representatives (ACRs) responsible for coordinating national activity

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1.1.1 Outline of original project

Strengthening stakeholder participation at national level was given the highest priority in the consultation process for Phase III of APINA. In agreement with this aspiration, the new APINA structure agreed at the Maputo Regional Policy Dialogue in 2003 included the creation of National Focal Points (NFPs) for APINA who sit in the Ministries of Environment and APINA Country Representatives (ACRs) who sit in institutions that have built up a relationship with APINA. NFPs liaise with Government and APINA on air pollution matters while ACRs coordinate APINA activities in the country.

The assumption is that the creation of these APINA posts, with their associated tasks and the holding of national stakeholder workshops will consolidate the flow of information on air pollution issues to and from the relevant stakeholders in each country. The national stakeholder meetings are to be convened by NFPs with assistance from ACRs. These meetings are to discuss national activities on

air pollution and to give an opportunity for stakeholders to discuss national air pollution issues and priorities. Task Team Members (TTMs) at national level are able to use this forum to present results emanating from APINA activities. Recommendations from such meetings then feed into the regional process via annual APINA meetings and Policy Dialogues. These stakeholders meetings were to be held in the first and third years of Phase III.

1.1.2. Deviation from original plan(s) and budget (with reference to current financial statement)

There were no stakeholder meetings scheduled for year two of APINA Phase III. However, with regards to payments the Malawi NFP and ACR have not yet been paid as they are still to finalise their first National Stakeholder Meeting report..

1.1.3. Results, outcomes and deliverables

The first National Stakeholder Meeting were successfully held in all the 7 participating countries during the first year of Phase III and reports have been produced and will soon be posted on the APINA website. The only outstanding report that needs to be finalized is for Malawi. In all cases relevant stakeholders attended the meetings and included local government officials overseeing environmental, health, energy, industry and transport issues; and representatives from industry and the civil society. All the meetings were officially opened by senior government officials - a further indication that governments are participating in APINA activities.

The NFPs and ACRs have continued to participate in APINA activities both at national and regional levels. The NFPs recently participated in the Decision Support Workshop held in Dar es Salaam in April 2007 to help TTLs have an insight on how to package information for decision-making. The organization of the meeting was done by the secretariat with facilitation by the Tanzania ACR.

1.1.4. Assessment and analysis of progress:

***A. General information and context concerning the issue being addressed by the RAPIDC activity*:**

The first Stakeholders Meetings had no defined terms of reference; hence different formats were used with some countries inviting a limited scope of stakeholders while others had a wide range; and the content of the programme varying with some only limited to presentations by APINA members while others included wider participation by stakeholders. This issue was discussed at the recent Decision Support meeting in Dar es Salaam in April 2007 and as a result the coordination team will design the terms of reference for the second round of stakeholders meeting scheduled for May/June/July 2007 so that maximum use can be made of these meetings to feed ideas and information into the next APINA Annual Meeting im October/November 2007and the Policy Dialogue in February 2008.

Generally air pollution is receiving an increasing amount of attention in the southern African countries. Most of these countries have either developed or are in the process of developing legislation on air pollution. APINA, through its NFPs and ACRs has been involved in either the drafting or implementation of the legislation on air pollution. Awareness is also increasing as evidenced by the attendance of various stakeholders at national stakeholder meetings and their willingness to participate. Infact, in the last ten years we have seen an increase in awareness air pollution issues such that in most countries those industries emitting gases to the atmosphere have to apply for permits to allow them to do so. In South Africa, the power to monitor air pollution has been

devolved to the local authorities who have to monitor the ambient air and work with industry to reduce air pollution.

APINA is now recognized as a champion for air pollution issues and engagement of governments in APINA activities through their ministries of environment will ensure ownership of the process. Industry is also keen to contribute to the national dialogues as evidenced by the case of South Africa where ESKOM, the energy utility, contributed financially to the organization of the National Stakeholder Meeting.

Furthermore, in several countries the national stakeholder meetings attracted significant media attention with APINA members in Mozambique, Zimbabwe and Tanzania appearing on television broadcasts.

B. Specific information relating to your RAPIDC activity:

At regional level, SADC has now revived the process of developing a SADC Protocol on Air Pollution. APINA is to participate in drafting the protocol through the MOU that APINA signed with SADC in 2001. Plans are underway for the Coordinating Team of APINA to visit the SADC Secretariat in June 2007 to map the way forward on this aspect and explore ways for further collaboration.

C. In addition, could you add:

(i) a paragraph on your project that you might put in a press release;

Air pollution is receiving an increasing amount of attention in the Southern African Development Community (SADC) region. APINA has contributed to this awareness by holding national stakeholder meetings on air pollution in seven SADC countries (Botswana, Malawi, Mozambique, South Africa, Tanzania, Zambia and Zimbabwe between December 2005 and March 2006. In all cases the relevant stakeholders attended the meetings and included central and local government officials overseeing environmental, health, energy, industry and transport issues; and representatives from industry and the civil society. The commitment of governments to improving regional air quality was demonstrated in all countries as senior government officials officially opened the meetings.

1.1.5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally e.g. north –south and south –south linkages etc

Not Applicable

1.1.6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

The second round of National Stakeholder Meetings will be in May/June/July 2007 where APINA Task Teams Members in the various countries will present results of Phase III activities and receive comments and inputs to take to the Regional Dialogue to be held in February 2008 in Botswana.

The activity has built capacity in the region in organising Stakeholder Meetings involving a wide range of participants. The involvement of national and local governments in the activities will contribute to the ownership of APINA activities. It is envisaged that in future governments and local organisations including NGOs and industry will sustain these meetings such that they become an annual event. In some countries such as Zimbabwe, APINA members are invited to present on air pollution issues and APINA activities at the Business for Sustainable Development annual meetings.

1.1.7. Gender, poverty and HIV/Aids issues relevant to project

In this activity, there are 2/7 ACRs (South Africa and Tanzania) and 1/7 NFPs (Tanzania) who are female and their participation has been effective. There is however need to improve on the gender balance.

1.1.8. Any other relevant comments/grievances etc

The budget allocation for this activity was the same for all countries. However, this proved to be inadequate for some countries due to the larger geographical area, the difference in economies and the number of people participating in the meetings. However, some countries had excess funds as most people were in the same town and smaller numbers of people attended the meeting. The allocation of funds among the seven countries will be reviewed in the future planning for this activity.

LFA 2.1: Ensure synergies amongst APINA Task Teams and with other regional and international initiatives

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: Ensure synergies amongst APINA Task Teams and with other regional and international initiatives	**Project Number:** 731215
Lead institutions: Institute of Environmental Studies and University of Zambia	**Prepared by:** RAPIDC Co-ordinators for APINA, Stephen Simukanga and Sara Feresu

Collaborating Institutions: (name; principal contact; contact details)

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2.1.1. Outline of original project

From the start it was clear that APINA must link with other relevant initiatives in southern Africa on air pollution and also make use of existing data where possible. To achieve this regional integration of activities a special expert workshop was to be held in the region at the start of Phase III to which all the prominent researchers in relevant fields would be invited, along with APINA Task Team Leaders. The aim of the meeting was to harmonise all existing activities in the region for each APINA activity area and ensure that synergies are identified and duplication of work is avoided. The meeting was to consist of each TTL presenting their planned activities in the regional context and guest experts presenting their work to fuel the discussion to the most strategic way forward. The workshop would produce a set of recommendations for each APINA activity area. In this way APINA would ensure that any problems/opportunities associated with the design of planned activities in the proposal can be identified at an early stage. **2.1.2. Deviation from original plan(s) and budget** (with reference to current financial statement)

There was no deviation from the original plan as the start-up workshop was held in July 2005 and the recommendations for each APINA activity area have guided the implementation of Phase III activities.

2.1.3. Results, outcomes and deliverables

Outcomes from this activity that have occurred since the start up workshop include the invitation for APINA to convene a Special Session at the international workshop on "Atmospheric Chemistry at the interfaces – 2006" organized by CACGP/IGAC/WMO; the co-organization of the Regional Conference on Better Air Quality in sub-Saharan African Cities (BAQ-SSA2006) with UNEP, World Bank, USEPA and USAID; attendance of the DEBITS meeting by the TTL for monitoring and the involvement of APINA in the GAP Forum, among others.

2.1.4. Assessment and analysis of progress:

A. General information and context concerning the issue being addressed by the RAPIDC activity:

The start-up workshop has created linkages between APINA and other initiatives in the region and internationally such that APINA is requested to participate in other regional and international initiatives and can access data from these initiatives. In addition to the initiatives mentioned in 2.1.3 Sara Feresu the head of the APINA secretariat was invited to participate in the writing of the Feature Focus: Energy and Air Pollution of the GEO Yeard Book 2006 of UNEPand the Chapter on the Atmosphere of the Fourth Global Environment Outlook (GEO4) of UNEP.

B. Specific information relating to your RAPIDC activity:

C. In addition, could you add:

(i) a paragraph on your project that you might put in a press release;

APINA is emerging as the most authoritative network on air pollution on the African Continent. In recognition of its activities APINA was allocated and convened a special session at the last CACGP/IGAC/WMO Symposium "Atmospheric Chemistry at the Interfaces – 2006" held in Cape Town, South Africa, September 2006 where it presented four papers show-casing APINA activities. The Symposium was attended by 400 people from all over the world. The APINA session was well

received and APINA received compliments from the organizers. Following this, Sara Feresu, the APINA manager was nominated to sit on the steering committee of CACGP.

International organizations also now look to APINA to co-organize regional events with them. A case in point is the BAQ-SSA 2006 which took place during July 2006 at the UNEP Headquarters in Nairobi which APINA co-organized with UNEP, World Bank, USEPA, USAID, NILU and IAEA.

2.1.5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally e.g. north –south and south –south linkages etc

There have been linkages within the RAPIDC Programme as proposed in the project document. First contacts with personnel from the Swedish institutions were made at the start-up workshop.Since then APINA has been in contact with IVL for developing logistics for carrying out the RUA activity in Maputo, Mozambique. The project has been launched with facilitation from IVL personnel.

Interactions have continued with SEI, withHarry Vallack providing technical support to the emissions Task Team;. Patrick Bueker and Lisa Emberson working with APINA on developing bio-monitoring studies in the region and Dieter Schwela together with Frank Murray of Mudorch University helping APINA on developing health activities and building capacity on impacts of health in the region. APINA is interacting with the KIMAB on the corrosion experiment through CORNET. Johan Tidblad is assisting with capacity building in the region. APINA. . APINA is also interacting with International Institute of Industrial Environmental Economics (IIIEE) of Lund, Sweden, on policy, mitigation and socio-economic issues on air pollution. Philip Peck, facilitated a workshop on decision support issues held in Dar-es-Salaam, April 2007.

There is collaboration with Malé Declaration countries particularly for the corrosion task through CORNET and biomonitoring activities through APCEN.

2.1.6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

This task was completed in the first year.

2.1.7. Gender, poverty and HIV/Aids issues relevant to project

Participants to the workshop were gender balanced as far as was possible.

LFA 2.2: Develop capacity in emission inventory preparation

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May/2006 – April/2007
Project Title: Develop capacity in emission inventory preparation	**Project Number:** 731225
Lead institutions: The Polytechnic, Mechanical Engineering Department, P. Bag 303, Chichiri, BT3, Malawi **Phone:** +265 1 670411 Fax: +265 1 670578 **E-mail:** kgondwe@poly.ac.mw	**Prepared by:** Kenneth Gondwe (Task Team Leader)

Collaborating Institutions: (name; principal contact; contact details)

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2.2.1. Outline of original project

It was envisaged that each country was to appoint an emission inventory preparation team which would be responsible for compiling its national emission inventory. Through the RAPIDC programme, an initial Training (Training Workshop I) would be attended by 2 members from each emission inventory preparation team during which users would become familiar with the basics of emission inventory building such as:

- emission source structure of the manual;
- characteristics and major emission sources of the pollutants to be inventoried;
- top-down versus bottom up approach;
- different units commonly used for activity data (and how to convert them into units appropriate for entry into the workbook);
- sources of activity data
- structure of the Excel workbook, how to navigate through it and how to enter the activity data, emission factors, emission control rates and so forth in order to generate national emission estimates;
- error checking and QA/QC procedures

In addition, the task team was to revise the emission factors based on the information from TTMs and ACRs. TTMs and TTLs would also provide feedback on the manual and so help to improve it for use in the region.

2.2.2. Deviation from original plans and budget

The activity is on track and the TTMs are in the final stages of compilation of the emissions inventories for their respective countries.

2.2.3. Results, outcomes and deliverables

As reported in the six monthly report, a second training workshop was held in South Africa, Cape Town in September 2006 to continue training TTMs in the use of the Emissions Manual. The training included the update in the manual regarding inclusion of point sources. Compilation of national inventories by the TTMs has been ongoing and was completed by 30 April 2007.

2.2.4. Assessment and analysis of progress:

***A. General information and context concerning the issue being addressed by the RAPIDC activity*:**

(i) Status of the issue

In Africa, urbanization and industrialization have increased regional concerns with regard to air pollutant emissions. Air pollution affects most of the major socio-economic sectors of the region

which include crop and animal production, ecosystems, human health and corrosion of material. Considering the fact that the region is principally an agro-based economy and that most of the rural population depend on subsistence agriculture for their livelihood, negative impacts on crops and animal production threaten food security and socio-economic development of the rural communities Evidence is starting to emerge of possible impacts of ozone on crops and natural vegetation. Air pollution in urban centres in Southern Africa has also been linked to human health impacts.

In order to understand the effects of air pollution on the environment, it is better to appreciate the various sources of air pollutants and their contribution to the impacts. To this effect developing emissions inventory is primary as this will give an insight into how the mitigation measures could be carried out as well as predicting the likely effects.

Awareness of the issue has grown over the last 10 years as evidenced by APINA's desire to develop emissions inventories and to carry out regional-scale air pollution modelling. Current capacity in regional air pollutant emissions inventory preparation is low although there does exist some capacity regarding GHG emission inventories as all APINA participating countries report on these emissions to the IPCC. This activity aims to train the emission inventory TTMs from the APINA countries in the use of the APINA Emissions Manual, so that the national emission inventories are comparable.

(ii) Capacity enhancement and assessment needs

There is a clear need for the enhancement of emissions inventory capacity in the region, both of individual and institutional level. The quality of activity data is often poor and access to it sometimes difficult - more cooperation from relevant ministries who have the data would be desirable. More awareness of the issue in those government ministries not directly involved in the APINA process would help.

(iii) Major trends

According to projections, if African countries continue to develop along a 'conventional development pathway' at predicted rates, by the mid-21st century their emissions of sulphur will exceed projected levels in Europe and the USA. A major and growing source of sulphur and nitrogen pollution across Africa is the combustion of fossil fuels in the power generation and smelting industries.

(iv) Prospects and progress of mitigation

The prospects for mitigation of current and projected future impacts are unclear. Once the major emission sources are identified, options for prevention and control can be considered and appropriate policies put in place to address the problem. APINA has a task team on mitigation/control that should package findings from APINA countries for presentation to the policy dialogue scheduled for February 2008.

(v) The significance of the regional approach

A regional approach for tackling transboundary regional air pollution is crucial. Adoption of harmonised methods for compiling national emissions inventories will facilitate meaningful atmospheric transport modelling (of deposition and effects). Opportunities for cooperation, transfer of knowledge, problem sharing etc are also enhanced.

B. Specific information relating to your RAPIDC activity:

This activity has built up, through a series of training workshops, a much increased level of capacity in the region to compile emissions inventories. First drafts of the national emission inventories (for the year 2000) have now been compiled by the task team members for all 7 APINA countries.

The project will provide input data for the regional-scale atmospheric transport modelling required to estimate impacts. It will also provide the basis for analyses of likely future emissions (and hence impacts) according to different scenarios. This will thus help raise general awareness of the issue and inform the policy making process in relation to the required emission prevention and control options.

C. In addition, could you add:

(i) a paragraph on your project that you might put in a press release;

Within the Regional Air Pollution in Developing Countries (RAPIDC) programme, Sida has funded APINA (Air Pollution Information Network for Africa) activities since 1998. One of these activities has involved capacity building in the preparation of harmonized national air pollutant emissions inventories for use in the management and control of regional air pollution in southern Africa. An APINA emission inventory preparation manual and associated workbook have been developed and a series of training workshops have been held (in Malawi and Cape Town) to enable task team members from the 7 APINA countries to compile national inventories of the major transboundary air pollutants. This will provide a quantitative basis for regional modelling of the transport, deposition and impacts of these air pollutants and so facilitate informed regional planning for the prevention and control of these emissions.

(ii) Summary of substantive progress

The APINA emission inventory preparation manual (and associated workbook) has been completed and is now being used by the task team members (TTMs) from the 7 APINA countries to compile their national inventories. The national inventory preparation teams are being trained by technical advisers from SEI. The first two workshops took place in Feb/March 2006 (Malawi) and September 2006 (Cape Town, S. Africa), and the final workshop is planned for October 2007 (Victoria Falls, Zimbabwe). The national inventories are being compiled and will be presented at the Zimbabwe workshop.

Technical capacity in emission inventory preparation has been significantly enhanced in all 7 APINA countries. Ownership of the APINA emissions inventory manual has been engendered by the close involvement of APINA during its development.

2.2.5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally e.g. north –south and south –south linkages etc

There has been regular consultation with the modelling, RUA and health Task Teams who will be required to use inventory data in their work. The second training workshop in September 2006 in Cape Town, South Africa, was held 'back to back' with the health impact workshop to enable interaction with, and input from the APINA participants and other air pollution experts from the region. The workshop was facilitated by the technical adviser, Harry Vallack of SEI who has continued to assist the TTMs in updating the inventories of their respective countries. TTMs for emissions attended the modelling workshop. The Task Team Leader for Emissions Team participated in the Decision workshop in Dar-es-Salaam, in April 2007 and will participate in the RUA workshop in Maputo in June 2007 to enhance linkages within these activities. Also, Frank Dentener from the Europe based EDGAR global emissions inventory initiative gave a presentation at the Cape Town workshop and the EDGAR people are very interested in collaborating with APINA on emissions inventory work in the region. Kenneth Gondwe (Task Team Leader) also collaborated with other international experts in the development of the Global Air Pollution Forum's emission inventory Manual which drew heavily on the APINA emissions inventory work.

2.2.6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

The Team will continue collecting activity and emission factor data at national level, based on the year 2000, compile preliminary national reports which will feed into a preliminary regional report. The inventories are being carried out with the support of the NFPs in the ministries of environment who have ensured this process and the inventories that will be developed will be owned by the ministries.

The third and final emission inventory training workshop will be held in conjunction with the annual APINA meeting scheduled to be held at Victoria Falls, Zimbabwe in October 2007.

2.2.7. Gender, poverty and HIV/Aids issues relevant to project

Women are involved in this activity.

2.2.8. Any other relevant comments/grievances etc

Although there have not been any major problems, failure to get ministerial approval in time meant South Africa was not represented at the Cape Town workshop in September 2006.

Notification to participants of final dates of workshops must be made well in advance to avoid problems with 'red tape'.

LFA 2.3: Establish/Enhance monitoring network in participating countries

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: Establish/Enhance monitoring network in participating countries	**Project Number:** 731235
Lead institutions: **Institution:** National Environmental Laboratory **Contact Details:** National Environmental Laboratory, P. Bag BR132, Gaborone, Botswana **Phone:** +267 3934479 Fax: +267 3934486 **E-mail:** bj44abi@hotmail.com or mdmmolawa@gov.bw	**Prepared by:** Mmolawa Moabi (Task Team Leader)

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2.3.1 Outline of original project

During the consultation workshop for Phase III in Tanzania APINA members defined the objectives on monitoring as being:

- Build capacity where it is lacking in Africa;
- Establish passive/active (particulate) sampling network;
- Enhance regional cooperation in the use of existing capacity.

In particular, training in the use of laboratory equipment, standardization of Quality Assurance (QA) and Quality control (QC) and Reporting, the installation of passive samplers in some participating countries and utilizing passive sampler technology available in south Africa at CSIR were discussed as priorities for the region.

Some countries in southern Africa have well established monitoring networks. These include South Africa, Botswana, Tanzania and Zambia but the data collected may not always be available for use or suitable for assessing the impacts of air pollution. In most countries, there are limited resources and shortage of equipment; both analytical and for monitoring. In Africa there are international initiatives for air pollution monitoring such as IDAF: International Global Atmospheric Chemistry (IGAC)/Deposition of Biogechemically Trace Species (DEBITS) programme in Africa. The DEBITS initiative also includes the RAPIDC CAD network in Asia and monitoring activities in South America. It was decided that a scoping activity should be conducted to look at the opportunities for collaboration with such existing networks to fill gaps in knowledge, especially when linking monitoring data to impacts.

Further, new monitoring activities and case studies would be identified to fill gaps in knowledge. The feasibility of APINA carrying out passive sampler monitoring to back up impact studies on health, crop yield reduction and corrosion would be explored. There was also an opportunity for APINA to participate in the passive sampler inter comparison exercise being conducted in south Asia for the Malé Declaration, where CSIR samplers could be calibrated for use in APINA activities.

2.3.2 Describe any deviation from original plan(s) and budget (with reference to current financial statement)

No deviation but the finalization of the scoping report and interaction with the Malé Declaration passive sampler intercomparison is a little behind schedule.

2.3.3 Results, outcomes and deliverables.

Results reported in the scoping report to date show that air pollution monitoring linked to national legislature on air pollution in the 7 APINA member countries is at various stages of development with some countries having no established AQM strategies. The status of air quality management in the seven APINA participating countries is shown in Table1. The final part of the scoping report will focus on opportunities for APINA to collaborate with existing monitoring initiatives in the region to fill gaps in knowledge and provide much needed monitoring data for air pollution impact studies.

Table 1: Status of Air Quality Management System in the Seven APINA member countries.

Country	Policy and Legislative framework place	Monitoring status
Botswana	• Atmospheric Pollution Prevention Act 1979. • Environmental Impact Assessment Act 2005.	• Monitoring started 1979. • National Air Quality management programme exist. • Parameters monitored: SO_2, NO_x, O_3, CO, MET, PM and HCs.
Malawi	• National Environmental Policy 1996. • Environment Management Act 1996. • Occupational Safety, Health & Welfare Act 1997	• Background monitoring started 1986, station now out of service. • No routine monitoring.
Mozambique	• Environmental Law of 1997. • Law of Municipalities in 1994.	• No coordinated AQM system. • Few sectoral studies conducted.
South Africa	• Air Quality Management Law. • National legislation on air pollution is currently being revised.	• No coordinated AQM system at national level. • Monitoring done by various agencies and local authorities • Parameters monitored: SO_2, NOx, O3, CO, PM, Pb, MET, VOCs, H_2S,
Tanzania	• Environmental Management Act (EMA) of 2004.	• Few sectoral studies conducted. • No coordinated AQM system • Parameter monitored: SO_2, NOx, Pb, CO, SPM.
Zambia	• Environmental Protection and Pollution Control Act 1990. • National Environmental Action Plan 1998. • Air Pollution Control Regulations and the Pneumoconiosis Act 1996. • Air Pollution Control Licensing and Emissions Standards Regulations of 1996.	• No coordinated AQM system. • Few sectoral studies conducted. • Parameters monitored: SO_2, NOx, and PM.
Zimbabwe	• Atmospheric Pollution Prevention Act 1971 • Atmospheric Pollution Prevention Regulations 1975. • Hazardous Substances and Articles Act 1979.. • Public Health Act 1979 • Environmental Management Act 2002	• No coordinated AQM system • Few sectoral studies conducted by various agencies mainly in City of Harare. • Parameters monitored SO_2, NOx, Pb, CH_4, NH_3 HCl, PM, black smoke, VOCs.

2.3.4 Assessment and analysis of progress:

A. General information and context concerning the issue being addressed by the RAPIDC activity:

Air pollution monitoring is crucial in assessing the impacts of air pollution in the region. The data obtained through monitoring activities helps to determine levels of exposure hence quantify the scope of the problem. Political by-in is critical as policy makers determine national direction in executing certain activities at national level, air pollution monitoring included. Although awareness is steadily increasing across all APINA member countries commitment to address the issue is still not adequate at government level.

B. Specific information relating to your RAPIDC activity:

At both national and regional level a range of air quality information is currently generated in various ways involving a number of agencies (governments or non governmental organizations) trying to satisfy a host of different specific user needs. Monitoring and research initiates are being carried out using a variety of methods and strategies which include, among others, sampling using continuous ambient monitoring equipment, wet and dry deposition monitoring using passive samplers, emissions monitoring, and monitoring in campaign type field experiments. Despite all the monitoring efforts, there is currently no or inadequate coordinated approach in all APINA member countries at national level for validation of the data or dissemination of the collected information for direct input into strategies addressing air pollution problems. The information is mainly put into databases in the format that cannot be applied directly by policy makers or easily understood by the public. A lot still needs to be done at national and regional level in assessing the impacts of air pollution in the region. These should include:

- Prescribing national norms and standards for air quality monitoring to ensure credibility of the data obtained and ensuring that a regional reference laboratory or laboratories are established.
- Encouraging development of national air quality information systems (AQIS) to feed into the regional one.
- Existing monitoring networks should be acknowledged and be integrated to ensure wider spatial coverage in national and regional networks and for synergy.
- Ozone and wet and dry deposition monitoring should be extended to areas where concern exists for ecological damage.
- Exchange of technical knowledge should be done through inter laboratory comparison and exchange programmes.

To achieve these, a deliberate effort should be made during the APINA Phase IV planning process that each country presents its national programme addressing these issues. The goals and workplans should be clearly indicated with milestones. Where assistance is required it should be clearly spelt out. A deliberate effort should be made to ensure that a forum is created for the Monitoring Task Team to meet and engage with each other to produce strategies with timelines for setting up national AQM systems.

2.3.5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

One aspect for this activity is the potential opportunity for southern African researchers who have developed passive sampler technology to participate in the RAPIDC passive sampler inter comparison exercise being organised as part of the Malé Declaration follow up. This will help build capacity in the region for use of locally manufactured technology. The aspiration is to reduce costs and make high quality measurements of air pollutants that could be reliably compared across the region.

There are also potential linkages to other programmes in the regions such as the urban air pollution monitoring supported by the African Regional Co-operative Agreement (ARA) for research, Development and Training.

2.3.6 Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

The Monitoring Team will continue with efforts to identify areas where collaborative efforts could be employed through APINA, to enhance air pollution monitoring activities in the region. The TTL will attend t the RUA workshop in Mozambique in June/July, 2007. This is to promote linkages with other Task Teams to see how monitoring could be linked to these activities.

2.3.7 Gender, poverty and HIV/Aids issues relevant to project

Not Applicable

2.3.8 Any other relevant comments/grievances etc

There are countries who feel that the monitoring task team needs to meet to discuss national programmes and help those that need support.

LFA 2.4: Enhance atmospheric transfer modelling and integrated assessment activities in southern Africa

RAPIDC Annual Report	**Period covered by report:** May 2006 – April 2007
Project Title: Activity 2.4: Enhancing atmospheric transfer modelling and integrated assessment in southern Africa	**Project Number:**
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2.4.1. Outline of original project

During the consultation workshop for the planning phase for APINA Phase III in Tanzania the following areas were identified as important by APINA members as far as atmospheric transfer modelling was concerned:

- Build capacity in dispersion and regional scale modelling where necessary;
- Establish centre(s) for regional scale modelling;
- Use regional scale modelling for impact assessment and validation studies.

The priorities for modelling activities were identified as:

- At national level emphasis should be in training in dispersion modelling, especially impact assessment at local level (Year1);
- Use regional scale modelling for impact assessment and validation studies;
- At regional level the priority should be to establish Centre(s) for Modelling (Year 1) and training in Regional modelling (Year 1);
- Crop impact assessments and validation (Year 2);
- Transboundary issues (Year 3).

Taking into account the recommendations from the consultation process and the practicalities of organising Phase III of APINA in the region, the following scoping exercise was designed:

- Conduct a scoping exercise and produce a report on the status of modelling efforts in the region so that modelling and integrated assessment requirements can be discussed and recommendations made for new activities;
- Conduct a feasibility study for installing a photochemical dispersion model in the region, forming the cornerstone of a modelling centre in the region for regional scale modelling;
- Training on atmospheric transfer modelling for two qualified personnel from each APINA country in Year 2 of Phase III;
- The collaboration between CSIR and SEI on modelling ozone deposition to crops and estimating risk of impacts should be ongoing in Phase III.

2.4.2. Describe any deviation from original plan(s) and budget

Originally the MATCH model was supposed to be installed at the Physics Department of Eduardo Mondhande University in Maputo, Mozambique. However it was decided to use the CAMx model for which there is expertise in the region. Also it was decided to train APINA members on local dispersion modelling before training them on regional modelling which is more complex.

2.4.3. Results, outcomes and deliverables

(a) ***Scoping Air Quality Modelling Activities in Southern Africa and the Feasibility of a Regional Modeling Centre***

The first major outcome and deliverable of this component of the project entailed a comprehensive scoping study that was conducted on the current modelling capabilities, the experience and the capacity in the various countries in the southern African region. The report also explored the feasibility of establishing a centre for regional scale atmospheric transport modelling in a southern African country. The findings are reported in ***Scoping Report: Air Quality Modeling Activities in Southern Africa and the Feasibility of a Regional Modelling Centre***, submitted to the APINA Secretariat.

The findings of this scoping study reveal that there is a dire shortage of qualified and experienced modellers in most southern African countries with the exception of Tanzania and South Africa. Two options were recommended to address the capacity gap, these are:

- For modellers to attend courses run specifically for the models that exist in their area of interest, or
- For an appropriate institution in either Tanzania or South Africa to develop a short course for a selected local scale model. Such a course could be run and repeated for groups in the region.

. The lack of capacity in southern Africa to conduct regional scale transport and deposition modeling is evident. Only one group at CSIR in South Africa has developed capacity and competence in this aspect of modelling. In order to bridge this capacity gap in a cost effective and efficient manner it is recommended to use this foundation as a point of departure.

Given the technical complexity associated with regional scale photochemical modeling a two phase approach is recommended. The initial phase should be a workshop to create awareness, to scope regional scale modelling issues and to identify suitable candidates for the second phase. Phase two should take the form of secondments of identified individuals to the proposed modelling centre. Secondments provide the benefits of working on identified projects in a mentorship mode with an established research team and provide the opportunity of sustained interaction over a period of time. It is believed that in this manner a core of individuals will develop and constitute a regionally strong team. The science will become rigorous and credible and the potential impact in air quality management decision-making on a regional scale will be enhanced.

(b) Capacity building in dispersion modelling

The second major output of this component of the project entailed a 5-day dispersion modelling course, hosted in Durban, South Africa, in February 2007, with two delegates, the task team member for modelling and that for the emission, from each of the 7 APINA countries. Dr Mark Zunckel and Atham Raghunandan presented the workshop. wh Only delegates from Tanzania and Botswana had some modelling experience prior to the workshop.

The workshop was held in the computer laboratory at the School of Environmental Sciences at the University of KwaZulu-Natal with sufficient computers for the delegates to work individually and in country-pairs. The 5-day workshop programme included theoretical lectures with the bulk of the time spent on practical exercises. The lectures

included air pollution meteorology (invited lecture by Prof Roseanne Diab of the School of Environmental Sciences), emissions inventories, the principles of air dispersion modelling and a lecture on modelling for impact assessments. The practical exercises used standard input datasets and took the delegates through a series of dispersion modelling exercises of increasing complexity. The first exercise focused on constructing wind roses and frequency tables. In a second exercise, the SCREEN III model was used to assess the impact of a hypothetical emission scenario with seasonal and diurnal wind roses used in the interpretation. Lastly, the CALPUFF suite of models was used for the same hypothetical situation to develop 2-dimensional wind fields, to model dispersion and deposition and to prepare isopleth maps and to plot time series of concentration data. Integration of the three exercises assisted in identifying strengths and weakness of the various modelling tool, and the benefits of using multiple approaches.

The workshop has served to expand the understanding on dispersion modelling among the APINA group and has provided the opportunity for the delegates to work with a number of models and to interpret their results in a hands-on practical manner. In order to become competent modellers it is important that the delegates build from the theoretical and practical foundation that has been laid through this workshop.

2.4.4. Assessment and analysis of progress:

***A. General information and context concerning atmospheric modelling being addressed by the RAPIDC activity*:**

(i) What is the status of the modelling in the relevant region?

- *How important to impacts?*

Atmospheric modelling is one of the important tools available to scientists/researchers to assess the nature and scale of impacts associated with air pollution. In southern Africa where there is a general dearth of good and reliable air quality data, modelling is regarded as an important surrogate to estimate ambient concentrations and deposition rates of pollutant species as input to impact assessment.

- *How important is atmospheric modelling politically?*

Atmospheric modelling is regarded as the most appropriate method to assess issues of transboundary air pollution. This issue is important politically.

- *What is the awareness of atmospheric modelling?*

There is a reasonable degree of awareness regarding modelling in the region among the scientific community. It is not clear that there is any awareness at the political level.

- *Has there been a change in awareness/relevance of atmospheric modelling in the region(s) in the last ten years?*

There has indeed been a change in both awareness and relevance of the atmospheric modelling issue in the region over the past ten years. Successful projects such as SAFARI 2000 and CAPIA

have used modelling to assess and communicate regional scale impacts. The modelling fraternity has grown in this time, particularly in South Africa.

- *What is the knowledge about atmospheric modelling in the region? i.e. how would you describe the current level of understanding of atmospheric modelling in the region(s) and what gaps remain to be filled?*

The baseline knowledge regarding atmospheric modelling, particularly at a regional scale, is low in all countries besides South Africa. This has improved somewhat following a focussed 5-day training course on dispersion modelling with two delegates in each country receiving training in using a number of important models and tools. This learning can only be sustained and modellers be developed if the delegates become actively involved in modelling in their working environments and further teaching is conducted to expand the size of the core group.

- *What is the level of capacity to study atmospheric modelling in the region?*

Atmospheric modelling requires good computing skills and basic science skills ranging from environmental science, engineering or meteorology that can be trained to undertake atmospheric modelling at various scales.

(ii) What are the capacity enhancement and assessment needs – institutions, activities and personnel and the importance of data quality etc?

Regional scale modelling is complex, data intensive, requires high-end computing facilities and requires researchers to specialise in the subject. Regional scale atmospheric modelling in the region therefore requires a coordinated approach through a modelling centre. Here selected specialists can develop in the field, have access to the necessary mentorship and computing facilities and be available to assist in research projects as the need arises.

(iii) Are there major trends for atmospheric modelling in the region(s) that you can identify?

The major trends for atmospheric modelling are a) local scale modelling to support air quality management planning at city level, and b) regional scale modelling as input to the debate on transboundary air pollution.

(iv) For impacts, what are the prospects and progress of mitigation in the region(s)?

There is no clear process for the mitigation of impacts in the region.

(v) The significance of the regional approach – needs, advantages, data exchange, personal – professional linkages etc

A clear need exists for a regional approach to atmospheric modelling considering the regional nature of air pollution transport and its potential impacts in southern Africa. The advantage of a regional approach to atmospheric modelling is that it gives other Southern Africa members the opportunity of professional linkages at the institutional and personal level with South Africa which has the capacity and resources in the field of atmospheric modelling. These linkages will allow for exchange of data, research ideas, joint implementation and the growth of a regional pool

of modellers. It allows the region as a whole to keep abreast with trends in the science. Furthermore, it provides the forum for consensus and joint input on regional scale issues.

B. Specific information relating to the atmospheric modelling RAPIDC activity:

(i) How is the regional approach advancing atmospheric modelling in the region? – what capacity is being built up and how does this relate to existing capacity?

The regional approach has served to make the initial steps in building capacity in dispersion modelling in the region through a focussed workshop. In so doing, the approach has created a strong awareness of the approaches to modelling, the data requirements, strengths and weakness of modelling in assessment studies. The regional approach has further served to create an e-mail modelling discussion group in the region where questions and opinions can be discussed and expert input provided.

(ii) What is the significance of the project and its progress to modelling of air pollution in the region?

The project has served to make the initial steps in building capacity in dispersion modelling in the region through a focussed workshop. The workshop has served to expand the understanding on dispersion modelling among the APINA group and has provided the opportunity for the delegates to work with a number of models and to interpret their results in a hands-on practical manner.

C. In addition, could you add:

(i) Recommendations for improvements

It is important to recognise the substantial differences that exist between dispersion modelling and regional scale photochemical modelling and the different skills requirements. Considering the relatively low expertise base in the region, it is recommended that efforts continue to focus on dispersion modelling. Once a strong base is developed the move to regional scale photochemical modelling will be somewhat easier to make.

2.4.5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

Strong links within APINA to the emission inventory team and the crop and ecosystem impact task teams. There has also been sharing of information between the Modelling TTL and SHMI on modelling approaches.

Some linkages have been explored between APINA and an initiative to establish the IIASA GAINS model in southern Africa. The objective is to capitalise on the co-benefits that exist between air quality mitigation and climate change. The initiative may be premature considering the relatively low priority that air quality shares on the regional political agenda, but the discussion is on-going.

See http://www.iiasa.ac.at/rains/gains/documentation.html

2.4.6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

Work planned for the coming 6 months are to conduct a case study in collaboration with the crops impact group to model surface ozone concentrations.

In the next phase of the project, focus should continue on building capacity in dispersion modelling and move towards country specific case studies. In this phase the move to regional scale modelling should be reassessed. In the event that the dispersion modelling skills have developed substantially it would be appropriate to review the development of a centre for regional scale modelling.

2.4.7. Gender, poverty and HIV/Aids issues relevant to project

There are no aspects that have specific relevance to gender, poverty and HIV/Aids issues.

2.4.8. Any other relevant comments/grievances etc

No issues.

LFA 2.5: Develop Rapid Urban Air Quality Assessment capability

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: Develop Rapid Urban Air Quality Assessment capability (Rapid Urban Assessment in Maputo, Mozambique)	**Project Number:** 731255
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2.5.1 Outline of original project

The **R**apid **U**rban Air Quality **A**ssessment (RUA) is a task falling under the activity of developing and/or enhancing technical capacity for air quality assessment in southern Africa as part of Phase III APINA activities. The aim of RUA is to build capacity in southern Africa on a newly developed, cost-effect methodology for the assessment of air quality (i.e., evaluation of emission levels and ambient concentrations of polluting substances in the ambient air) at urban scale. By virtue of RUA being a fast methodology, it is anticipated that its introduction and implementation in southern Africa will enable early focus on devising and implementing cost-effective strategies for the abatement of urban air pollution in the region. Fast and reliable tools such as RUA for the assessment of urban air quality are needed in southern Africa, where urbanisation and industrialisation are currently on the increase, thereby raising concerns on air quality degradation due to increasing emissions of air-polluting substances from human activities into the atmosphere.

RUA is being curried out demonstratively in Maputo, the capital city of Mozambique, as a case study for southern Africa. The experience gained in Maputo will be imparted to other cities within the APINA region through regional training workshops. The RUA activity is coordinated jointly by the Swedish Environmental Research Institute (IVL) and the Department of Physics of Eduardo Mondlane University (UEM) in Maputo, Mozambique. The Maputo City Council facilitates the implementation of RUA through a specific Memorandum of Understanding (MoU) signed with UEM, on the 15th of February 2007.

2.5.2 Deviation from original plan and budget

The implementation of RUA in Maputo was initially planned to start off during the last quarter of 2006. However, the delay in the selection of a candidate city (due to the need to confirm availability of certain data and information) caused the late commencement of the activity. Furthermore, there was an error in the travel budget specified by SEI and IVL was awaiting acceptance from SEI to take these travel funds from the contingency budget, to initiate activities in Maputo. However, one year of monitoring will be performed within Phase III.

The official launch of RUA in Maputo took place on the 15th of February 2007. The Mayor of Maputo and senior members of the City Council, the Rector of University of Edwardo Mondlane (UEM) and the Deputy Director of IVL witnessed the ceremony, which coincided with the signing of the MoU between the City Council and UEM on issues pertaining to air pollution research and air quality management.

2.5.3 Results, outcomes and deliverables

Since the RUA activity in Maputo is in its formative stage, there are no substantive results, outcomes and deliverables to report on at the moment. However, it is worth mentioning that the launch of RUA

has contributed substantially to raising of awareness of the municipal authorities on the issue of urban air pollution and its potential consequences in Mozambique. RUA has been welcomed by the Maputo City Council and has been virtually incorporated into the City's integrated strategy to improve the quality of the urban environment.

2.5.4 Assessment and analysis of progress

A General information and context

Air pollution caused by emissions into the atmosphere of gaseous and particulate matter from human activities is an emerging and rapidly growing problem in southern Africa. The problem is associated with the increasing economic and industrial activities, promoted by relative political stability following the end of armed conflicts and political strives in the region.

Major human activities contributing to the growing burden of emissions in southern Africa include the combustion of fossil and wood fuels for energy generation (in all sectors of the economy, namely transport, industry, mineral exploration, agriculture, services and households), mining operations, and the use of fires for managing agricultural and ecosystem conservation land. These activities have been growing in intensity and extent as the population in the subcontinent continues to grow.

Urban areas are the major sources and the most affected by air pollution, due to the concentration therein of people and diverse and complex human activities. Emissions into the atmosphere from transport, industrial and solid waste disposal operations rank higher in these areas than elsewhere in the region.

One of the activities put forward in the APINA work plan for Phase III of the RAPIDC Programme has been the development and/or enhancement of technical capacity in air quality assessment through training on emissions inventories, monitoring of pollutant concentrations in the ambient air, modelling of transport and fate of air pollutants in the atmosphere, and risk/impact assessment. In the framework of this activity, training workshops on air pollution emissions inventories, dispersion modelling and impacts assessment have been carried out by APINA in the region during the past year (2006).

RUA is a task aimed at developing and/or enhancing technical capacity for air quality assessment in southern Africa.

Accordingly, the implementation of RUA involves the following steps:

(i) Preparation of an emissions inventory of air-polluting substances;

(ii) Validation of the emissions inventory database through field measurements of concentrations of air-polluting substances in the ambient air;

(iii) Linkage of the emissions inventory database with a suitable dispersion modelling to estimate ambient concentrations of air pollutants everywhere within in the study domain;

(iv) Validation of the model estimates by comparing these against measured concentrations of polluting substances in the ambient air;

(v) Assessment of the risks related to exposure of people, ecosystems and materials to the observed ambient concentrations of air pollutants; and

(vi) Assessment of the economic implications related to these risks.

The novelty of RUA resides in the introduction of geomatics[1] as an emissions inventory tool, together with the conventional top-down/bottom-up approaches. That is, in RUA emission estimates are obtained via a set of procedures involving parallel processes:

- Gather national, regional or provincial data on material use and activity rates and apply process-specific emission factors to produce emission estimates and then scale these down to the inventory domain of interest (e.g., a city)—this is the top-down approach.

- Conduct a survey of emission sources by type (e.g., point, line and area sources) and use process-specific emissions factors to produce emission estimates for each source or source type within the inventory and then sum these up to obtain emission estimates for the entire domain—this is the bottom-up approach.

- Perform measurements of concentrations of air-polluting substances in the ambient air at selected sites, close to and far way from the emission sources, and then use the measured ambient concentrations of air pollutants to calibrate and validate emission estimates obtained using top-down/bottom-up procedures. The use of an inexpensive but reliable measurement technique (such as diffusive sampling of atmospheric constituents), is recommended to keep the operational costs low.

- Use satellite imagery or aerial photography, merged with a geographic information system (GIS), to determine the location and spatial extent (type) of emission sources, as well as the characteristics of measurement sites, through analysis of land-use and land-cover data using remote sensing techniques (photogrammetry and digital image analysis)—here is where geomatics comes in to play a role.

- Use land-use and land-cover data coupled with field data on ambient concentrations of air pollutants to develop source-specific emission factors weighted by appropriate demographic data (e.g., population density), then use these emissions factors and GIS software to produce emission maps for the inventoried species over the inventory domain—here again, geomatics play a role.

Clearly, the end product of the 5-step process above is a map (grid) showing the spatial distribution of emissions over the inventory domain in a given time period. This emissions database can then be coupled with an appropriate air pollution dispersion/transport model to produce concentration estimates of air pollutants in the ambient air over the study domain, under any prevalent atmospheric conditions therein. Here again, a call is made to use the field data on ambient concentrations of air pollutants to calibrate and validate the modelled ambient concentrations of air pollutants. Finally, the validated concentration data can be used for risk assessment and impact analyses, thereby enabling knowledge-based development of air pollution abatement strategies

[1]Geomatics is the science of acquiring, modelling, analyzing and managing spatially referenced data, i.e., data identified according to their locations. Based on the scientific framework of geodesy, it uses terrestrial, marine, airborne, and satellite-based sensors to acquire spatial and other data. It includes the process of transforming spatially referenced data from different sources into common information systems with well-defined accuracy characteristics.

2.5.5 Specific information

The RUA methodology was developed at IVL and applied and tested in Sweden, before a decision was made to impart the experience to developing countries through the RAPIDC Programme. It involves combining the conventional top-down and bottom-up emissions inventory approaches, linked with field measurements and numerical modelling of pollutant concentrations in the atmosphere, with geomatics to determine the severity of both air-pollutant emission levels and exposure thereto, and map the source and/or affected areas within a given domain.

RUA in Maputo is coordinated and carried out by the Department of Physics of UEM (DPUEM), on behalf of APINA, with technical assistance provided by IVL. A local team consisting of eight (8) people with acceptable level of expertise in relevant technical disciplines has been assembled and is currently working on the development of the emissions inventory required for RUA.

IVL participated in visits to local data providers, CENCARTA, and GEOLAB at UEM. Three local training workshops have been carried out on relevant aspects of RUA, including a 3-day long RUA training facilitated by IVL where 10 local experts from UEM participated. The training included all essential phases of the RUA methodology;

- Emission inventory, major point sources, line sources and area sources.
- Identification of emission sectors and linkage to emission data, top-down and bottom-up approaches.
- Linkage between emission sectors and geographical features in remote sensing data.
- Planning for the passive sampler campaign which was initiated in the end of February.

The monitoring activities started in March 2007. A presentation of the principal theory and practical use of the passive sampler technique, as well as network design and site selection criteria, was made.

The local APINA partners are already familiar with atmospheric chemistry and GIS modelling. The implementation of activities was efficiently performed and the people involved seemed very enthusiastic.

Most of members of this local team are university lecturers, which ensures that the expertise imparted to them in these workshops will be passed on to students. In fact, the team organises and conducts campaigns gathering the data required for the RUA emissions inventory with the involvement of students, who are taught in the process on how to design and carry out experiments to collect scientific data and perform quality assurance/quality control (QA/QC) on these data. The air pollutants of interest in RUA include sulphur dioxide (SO_2), nitrogen dioxide (NO_2), benzene (C_6H_6) and inhalable particles (PM_{10}, $PM_{2.5}$). Figure 1 shows the coverage of the field measurements of these pollutants in Maputo and the nearby City of Matola.

Additional information

The official launch of RUA on the 15th of February was widely covered by the media. A plan is being developed by the local RUA coordination team in concert with the Maputo City Council to brief the media on the progress of this project. So far, RUA activities have been progressing well.

2.5.6 Linkages

Maputo RUA is linked to similar activities ongoing within the framework of the RAPIDC Programme. RUA is ongoing in Kathmandu, Nepal, as part of the Malé Declaration activities, and lessons learned there have been used during the emissions inventory and sampling methodology workshops held in Maputo.

2.5.7 Future developments

A regional workshop on the RUA methodology will be held in Maputo June 2007 to impart the experience to other countries in southern Africa. This workshop will involve people drawn from the APINA Task Teams for emissions inventories, air pollution monitoring, and air pollution impacts on human health, crops, ecosystems and man-made materials as activities in RUA encompass these areas.

The results from RUA will be used to assist in the development an Air Quality Management Strategy for the City of Maputo. Negotiations are ongoing to use contingency funds to allow Dieter Schwela and Gary Haq of the RAPIDC APMA project to attend the June/July workshop and train local Maputo AQM stakeholders in the Strategic Framework for AQM approach that has been developed and applied in Asia and will also be part of the Kathmandu RUA project.

In 2008 APINA will convene the III Regional PD on Air Pollution and its Likely Trans-boundary Impacts in Southern Africa. The results of the Maputo RUA will be presented at this meeting.

2.5.8 Gender, poverty and HIV/AIDS

Air pollution is known to have negative effects on the human health and the environment. Human health can be adversely affected by air pollution through direct pathways such as inhalation but also indirectly via other exposure routes such as contamination of drinking water and food and via skin transfer. The direct health effects of air pollution on humans can vary according to the intensity and duration of exposure to polluted air as well as the health status of the subjects exposed. People with a poor standard of living suffer from nutritional deficiencies, infectious diseases due to poor sanitation and education, and tend to be provided with a poor standard of medical care. Each of these factors may render individuals more susceptible to the effects of air pollution.

In southern Africa most people live under the poverty line and a significant number of these live with HIV/AIDS. Though no study has been conducted linking HID/AIDS and air pollution exposure in the region, it likely that the increasing levels of air pollution in the southern African region bear a significant contribution in the number of deaths associated with HIV/AIDS, especially in urban areas. The adoption and mastering of RUA as a tool for assessing air quality in urban areas will pave the way for such studies to be conducted and enable informed decision making on relevant issues in the region.

Figure 1: Locations of the RUA measurement sites in Maputo, indicated by coloured pins. Yellow pins indicate year-long bi-monthly sampling sites for NO_2, SO_2 and PM10; green pins indicate two bi-monthly sampling campaign sites for NO_2/SO_2 and PM10; finally, the red pins indicate two 1-week sampling campaign sites for benzene.

LFA 2.6: Strengthen knowledge on impacts of air pollution on human health

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: Strengthen knowledge on impacts of air pollution on human health	**Project Number:** 731265
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2.6.1 Outline of original project

During the consultation process for health impacts two areas of interest were identified:

(i) Assessment of impacts of air pollution on health and wider societal impacts using concentration data and dose-response relationships;

(ii) Measuring health effects of air pollution through cohort, time series or cross-sectional studies. However funds were only allocated for assessment of impacts of air pollution on health, and wider societal impacts, using concentration data and dose-response relationships

Task Team Members were to be trained on methods and applications to be used when collecting pollution monitoring and population data for cities. These methods would then be used to assess the impacts of air pollution on health, and wider societal impacts, using a combination of relevant monitoring data and any epidemiological studies that have already been carried out. This activity on health would:

- train Task Team Members on simple, cost effective methodologies for health risk assessment;
- use the health effects Task Team to conduct case studies on health impacts in as many countries as possible of the participating countries in southern Africa (Botswana, Malawi, Mozambique, South Africa, Tanzania, Zambia and Zimbabwe);
- conduct training workshops and workshops to synthesize results coming from the participating countries;
- Compile factsheets for dissemination and for the policy dialogue in Year 3 on results on health impacts of air pollution in southern Africa.

The project would involve:

(i) Identifying a network of project members at national level through TTLs and TTMs;

(ii) Defining data requirements and standard procedures, developing a feasibility matrix, providing contextual information and explaining how to use data. (by e-mail, etc);

(iii) Holding a first workshop for twenty participants to present available data, provide tools and techniques for data manipulation, and identify tasks based on available data.

(iv) Tasks would then be conducted in cities with available data and technical capacity and the results discussed at a second workshop. The first workshop would be held in conjunction with the rapid urban air quality assessment and the emission inventory workshop and opportunities for synergies amongst the project explored.

2.6.2. Describe any deviation from original plan(s) and budget (with reference to current financial statement)

The late start of the RUA project in Maputo meant that the health workshops could not be held in conjunction with the RUA project but the second health workshop was held back to back with the second emissions inventory workshop with some joint sessions.. The Health TTL will be attending the RUA workshop scheduled for June/July 2007 in Maputo.

2.6.3. Results, outcomes and deliverables

Results of undertaken activities:

- There is now an active Task Team on health impacts active across seven countries in the region.
- Country papers and reports on existing relevant local data and case studies on air pollution health impacts in member countries. Botswana, Malawi, Mozambique, South Africa, Tanzania, Zambia and Zimbabwe were submitted and presented at the second training workshop. o
- Air Quality Model training and results using the Simple Interactive Model for Better Air Quality (SIM-AIR version 1.1). Out of the seven countries, only the Tanzania TTM completed the SIMAIR model task. The other TTMs did not complete the task as it required more than the anticipated resources, particularly time, personnel, data and money.
- Training on assessment methods, tools and application. The main purpose of this activity was to train Task Team Members on simple, cost effective methodologies for health risk assessment. At the workshop possible epidemiological studies, suitable for southern Africa countries, were discussed for potential implementation after the workshop. For this purpose a CD was distributed with WHO material on how to produce valid epidemiological studies.
- The development of project proposals for specific air pollution health impact studies in participating countries (see Table 2).
- Workshop report for the second training workshop.

Table 2: National Air Pollution Health Impact Study Priorities in Southern Africa

COUNTRY	STUDY PRIORITY	LOCATION	POLLUTANT	IMPACT
Botswana	*Ambient air quality*	Selibe Phikwe	*PM_{10} and SO_2*	Visible vegetation damage already identified as a national concern
	Ambient air quality	Gaborone – informal settlement – old Naledi	*Vehicle emissions*	Visibility and ARI
Malawi	*Indoor air quality*	Malawi rural areas where majority of the population lives and peri-urban poor	*PM and CO*	*Mothers and children <5years old – currently no data and no studies*
	Ambient air quality	Malawi urban areas- coal mining and cement plant	*Dust/PM*	
Mozambique	*Indoor air quality*	Rural areas- 60% of population rural	*NO_2, SO_2, PM_{10}, CO, CO_2 and Pb*	*Pulmonary and respiratory diseases*
	Ambient air quality		*Aerosols, O_3, Pb, Hydrocarbons and Asbestos*	
South Africa	*Ambient air quality – follow-up on work done;*	The Vaal Triangle	*PM and VOCs*	*Natural experiments on health impacts- 11 000 children*
	Epidemiological studies;	South Durban – Power stations	*Mercury*	*Cancers*
	Vehicle emissions- linkages to policy			
Tanzania	*Indoor air quality*	Rural and poor peri-urban areas	*CO, CO_2, NO_X, SO_2, PM_{10} and $PM_{2.5}$*	*Pulmonary and respiratory diseases*
	Ambient air quality	Urban and peri-urban		*c*
Zambia	*Indoor air quality*	Rural and poor peri-urban areas	*PM_{10}, CO, CO_2, NO_X,*	*Pulmonary and respiratory diseases*
		Lusaka – open air		

COUNTRY	STUDY PRIORITY	LOCATION	POLLUTANT	IMPACT
	Ambient air quality	burning	*SO_2, and PM_{10}*	
Zimbabwe	*Indoor air quality* *Ambient air quality*	Rural area – 60% of population Poor peri-urban Urban areas – vehicles and industry	*PM10 and CO* *PM and O_3*	*ARI in women and children <5years old*

2.6.4. Assessment and analysis of progress:

***A. General information and context concerning the issue being addressed by the RAPIDC activity*:**

(i) What is the status of the issue in the relevant region?

There is generally limited knowledge and literature on the health impacts of air pollution in Southern Africa, particularly information required to feed into the policy making process and raise civic society awareness. Furthermore, other impacts including economic and social have not been addressed due to the lack of data and in some cases limited technical capacity. According to the results of the scoping study and a review of the existing data on studies carried out on Southern Africa, APINA workshop reports, country reports, fact sheets, the task team still has to develop more databases and case studies to use as evidence of the adverse health impacts of air pollution on the population of Southern Africa in order to convince policy makers that air pollution is a problem in the region.

Air pollution levels in Southern Africa have an adverse impact on public health. Health effects such as respiratory illnesses have been observed in people exposed to air pollution particularly in areas where levels are reported to be high. The magnitude of impacts is however not fully understood.

However, in recent years, increasing attention has been paid to environmental pollution and attendant health effects in Africa. Mostly, attention has been paid to respiratory effects although in the last few decades focus has shifted to include other systemic conditions such cardiovascular, reproductive, haematological and cancers. Both laboratory and epidemiological studies have mostly focused on effects associated with criteria pollutants, namely, SO_2, PM, NO_2, O_3, CO, and Pb.

Furthermore, there has been significant change in the level of awareness and interest to participate in APINA and air quality management activities in the last few years. This is seen through requests for information from both the civic society and government departments as well as the active participation of the same groups in APINA stakeholder activities. The industry has also shown willingness to participate by inviting Task Team members to make presentations and provide information at relevant meetings.

(ii) What are the capacity enhancement and assessment needs – institutions, activities and personnel and the importance of data quality etc?

Available information and studies reveal that air pollution is a cause for concern for the Southern Africa region. The data and technical capacity, however, are limited, and need to be addressed in

order to address the health impacts of air pollution in the region. The following specific recommendations on the actions required were made by the health task team:

- Characterisation of exposure conditions in the region;
- Characterisation of regional health impacts of air pollution;
- Characterisation of socio-economic status of the southern African population and its relative impacts on the air pollution/health relationship;
- Improvements in air quality monitoring; and
- Development of appropriate education programs for the general population.

(iii) Are there major trends for the issue in the region(s) that you can identify?

Ambient air pollution levels in certain parts of the region are above recommended national and WHO air quality guidelines for the protection of human health. High concentrations particularly of SO_2 are experienced mainly in urban areas of Botswana, South Africa, Zambia and Zimbabwe where major sources of ground level concentrations of air pollution are found in large numbers.

Indoor air pollution has not been studied to a great extend in Southern Africa and as such there is little information on levels and effects. Available indoor air pollution data show that households that rely on solid and liquid fuels to meet their energy needs, experience elevated levels of indoor air pollution.

Studies on health impacts associated with air pollution in the region have focused more on the respiratory system. Effects such as wheezing, cough, asthma, decrements in lung function have been observed in populations exposed to high ambient and indoor levels of air pollution. These observations are made from studies conducted in South Africa and anecdotal evidence from other countries.

In characterising health effects associated with air pollution, the studies reveal that the existence of other risk factors such as poor nutrition, low levels of education, low socio-economic status, and behavioural choices may compound the observed effects in populations exposed to air pollution

The survey on perceptions on air pollution showed that the respondents had different awareness levels of the health impacts of air pollution in the different countries.

(iv) For impacts, what are the prospects and progress of mitigation in the region(s)?

The problem of air pollution is not only due to inadequate policies to abate it. Other compounding issues include lack of capacity to implement the requirements of the policies, lack of coordinated efforts amongst the various governmental departments in reducing air pollution, and the socio-economic development issues and attendant problems.

In answering the question on what has been done to reduce health impactthe workshop participants indicated that not much has been done in most of the countries to-date; hence, a list of requirements and challenges was drawn up instead:

- Legislation/legislative bodies (some more than one) exist but appropriate for certain contexts and enforced to varying degrees.
- The need to link policy to action.
- The need to be careful creating new problems by new laws

- Very little public access to information, public awareness is very low
- Indoor air pollution will be a challenge to regulate.

B. Specific information relating to your RAPIDC activity:

(i) How is the regional approach advancing the issue in the region? – What capacity is being built up and how does this relate to existing capacity?

Information and knowledge concerning air pollution impacts on health is not evenly distributed across southern Africa and different countries are at different stages of awareness and action. International and national funding for studies on impacts is also unevenly distributed. The presence of the APINA Task Team is ensuring that these disparities are now being addressed and that the shared problems of urban air pollution in the region now have a chance of being tackled in a more effective and coherent manner.

(ii) What is the significance of the project and its progress to the issue of air pollution in the region? For example, if it is an impacts activity – how does it relate to the sum total of impacts related activity in the region? Or how does the monitoring relate to other on-going monitoring? If it is policy related – how does it relate to overall policy development in the region? Etc.

As stated above, the Task Team on health impacts is fulfilling an essential role in southern Africa by facilitating the sharing of information and know-how across the region. Further progress can only be made by linking strongly with the existing activities of other networks and funders throughout the region.

C. In addition, could you add:

(i) a paragraph on your project that you might put in a press release;

Impact assessments are still to be carried out in the different countries and project proposals are being developed for application for funding, hence, there is not much yet in terms of substantial evidence of impacts suitable for a press release. Major concerns, however, are the effects of indoor air pollution on women and children, workers and population exposed to high concentrations of sulphur dioxide, particulate matter and other pollutants near industrial installations (especially smelting operations), exposure of poor urban communities to a cocktail of toxic emissions from the burning of waste on municipal dumps and vehicle emissions.

(ii) a summary of substantive progress;

The Cape Town workshop achieved its goal of further strengthening knowledge on impacts on air pollution on human health. This was accomplished through sharing experiences and results of assessment tasks of impacts of air pollution on health (e.g. using the SIMAIR) model and country reports on relevant case studies. The results of this workshop are expected to contribute towards managing the air pollution problems facing most of the region's rapidly developing urban areas.

In terms of capacity reinforcement, advice was given by the technical advisors and fellow TTMs on study design and methodologies, including statistical considerations, research question formulation, and intervention priority setting. All participants were given the time to put to practice the advice and experiences during breakaway sessions which were followed by presentations and discussions with the rest of the group. Participants were thus able to come up with scientifically sound case study designs for implementations in their respective countries. The team also began the synthesis of an integrated impacts report in preparation for the next policy dialogue meeting.

Considering the above discussed activities the team is progressively building up scientific knowledge fundamental for political action to reduce the air pollution impacts in southern Africa. The bringing together of fourteen TTMs from the seven participating countries ensured sharing of experiences, resources and creates a foundation for a common basis of operation for the region.

(iii) any interaction with the region in terms of help 'in kind' and financial assistance;

The Botswana Government is funding and has adopted the Botswana TTM to conduct an impacts study at Selebi Phikwe related to the APINA work on health impacts. In Mozambique students are collecting data related to the APINA activity funded by local money.

A concept note for a proposal to collect air quality baseline data for Malawi is being developed under the leadership of Dr. Brandon Barnes, and negotiations are underway with the Medial Research Council of South Africa to fund the project.

(iv) progress on capacity building and ownership detailing prospects for sustainability of built capacity;

Phase III of APINA has seen the start of capacity building activities for the assessment of health impacts across the southern African region, as well as enhanced sharing of available information among the countries. It is hoped that the APINA Task Team on Health Impacts can continue to stimulate new studies and collaborations and that the funds required for sustaining the process will be forthcoming. The financial assistance and interest shown by various bodies in the region to date (see (iii) above) is encouraging.

(v) major problems/ set backs;

The team reached a consensus that strategies to mobilize the following were vital to the successful completion of in-country activities:

- Students for personnel and funds to pay for services, time and data
- Contact the APINA National Focal Points (NFPs) for assistance with access to required data which had proven difficult;
- Man time from work to supervise the collection of data

(vi) recommendations for improvements

Health impacts are an important shared regional problem for both urban and rural communities and are particularly marked for the poorer communities. The health Task Team has a key role in APINA to mobilize the evidence of impacts that is required by policy makers for concerted action across the region. The Team has made a good start but it is essential that this is consolidated by utilizing existing knowledge and activity in the region and encouraging new activities and partnerships.

2.6.5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally e.g. north –south and south –south linkages etc

Strong linkages have been developed within the various APINA task teams, between the participating countries and with the technical experts from Australia, UK, and South Africa. These linkages are playing a vital role in providing continuous technical back-stopping and provision of information and direction towards relevant activities in other parts of the world.

2.6.6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

TTMs were tasked with completion of assessments in collaboration with fellow TTMs and technical advisors by mid-November 2006 to allow time for the synthesis of the integrated regional air pollution health impact assessment for the 2008 policy dialogue meeting. Further, case studies developed during the workshop are expected to be implemented in the respective countries following the national priorities and research questions presented during the workshop. After the Methodologies and Study Designs training session the different country representatives developed research questions which reflected a mixture of indoor and outdoor air pollution; different pollutants and different setting. For some countries questions were detailed and analytical, the others required descriptive information and in the case of Malawi baseline studies were required to generate future research questions.

The team is also in the process of working on collaboration logistics and writing project proposals to source funding required for the implementation of case studies.

An integrated Air Pollution Health Impacts report was also expected to be ready by the end of December 2006 but is now in preparation.

2.6.7. Gender, poverty and HIV/Aids issues relevant to project

There is general consensus that the issue of indoor air pollution needs to be considered seriously as it affects the poor (mostly rural and peri-urban), women and children and in most cases those suffering from HVI/AIDS. This sentiment is also strongly reflected in national priorities listed and case study research questions developed by the team members from the participating countries.

Gender Issues:

Women in Southern Africa and their children make up a significant portion of the 3.5 billion people mostly in rural areas and poor sections of cities world-wide exposed to high indoor air pollution due to poverty. The exposures to emissions from traditional cooking fuels are known to exceed the WHO daily average guideline by a factor of 10 or more. WHO estimated that of the 3 million/annum premature deaths, 2.8 million are due to indoor air pollution, and it is estimated that the largest number of deaths will occur in India, followed by Sub-Saharan Africa. These statistics are likely to be made up of more women and children than men owing to the fact that women and children spend more time in areas of high emission levels during cooking and other household activities. Consequently, they are expected to make up a large proportion of air pollution related mortality statistics and to be affected by acute respiratory infections (children), chronic obstructive lung diseases such as asthma and chronic bronchitis, lung cancer and adverse pregnancy outcomes. Hence,

the importance of ensuring gender sensitivity in the APINA project activities, especially the case studies, awareness campaigns and most crucially the policy development and implementation process.

Poverty Issues:

A large part of the poor population of Southern Africa (rural and peri-urban) relies on bio-fuels for cooking and space heating, resulting in exposure of this population to high levels of harmful emissions in the living environment. Furthermore, some of these people are also exposed to high levels of both outdoor and work environment pollution. Inclusion of the affected poor population of Southern Africa in the Air Pollution Health Impacts studies and awareness raising activities can go a long way towards encouraging behavioural change and advocacy.

2.6.8. Any other relevant comments/grievances etc

Efforts to access some of the relevant government funds seem to have been generally unsuccessful.

LFA 2.7: Strengthen knowledge on impacts of air pollution on crops

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May/2005 – April/2006
Project Title: Strengthen knowledge on impacts of air pollution on crops	**Project Number:** 731275
Lead institutions: CSIR Environmentek, **Contact Details**: CSIR, Box 17001, Congella 4001, Durban, South Africa **Phone**: +27 31 2422345 Fax: +27 31 2612509 **E-mail**: amvantienhoven@yahoo.com	**Prepared by:** Anna Mieke van Tienhoven (Task Team Leader)

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2.7.1. Outline of original project

This task comprises two activities:

- Identify where risks of crop yield reductions may be occurring; and
- Demonstrate where risks of crop yield reductions are occurring

Provisional risk assessment exercise

This study would identify ozone hot-spot areas across southern African using modelled ozone concentration data from the CAMx model run by CSIR (supplemented by measured data as available). Agricultural data would be supplied from the IGBP land cover map with supplementary information (e.g. crop distribution statistics, growing season information) collected from the APINA network as appropriate. These data would be combined using provisional Air Quality Guidelines (AQGs) recommended by the APCEN (Air Pollution Crop Effect Network) scientific network which has been established within RAPIDC and comprises leading air pollution effects scientists. For example, the exercise would most likely use existing AQGs that have been developed in both America and Europe for maize, a staple crop of the southern African region that characterise ozone according to 7 hour mean or Accumulated Over Threshold (AOT) concentrations. The areas across the region where these thresholds are exceeded would indicate locations where the agricultural crops may be at risk of damage from ozone, the magnitude of the exceedance would provide an indication of the spatial distribution of relative risk. Finally, the production of maps showing exceedance would form the basis of a policy document that would be prepared for circulation and presentation at the third APINA regional policy dialogue planned for early 2008.

Bio-monitoring campaign.

Assessment of actual crop damage by ozone would involve the establishment of a simple bio-monitoring study at a number of sites (at least 4) across southern African. The study would use a simple clover bio-monitoring method (developed and applied extensively in Europe) to assess visible injury and biomass reductions resulting from exposure to ozone pollution, hence demonstrating the potential for ozone damage to sensitive crop species. The protocol would have been developed and piloted by APCEN to ensure its suitability for southern African conditions and the method presented to the participating APINA network members at a training workshop. The study sites would be located on consideration of i) availability of facilities and expertise (e.g. capacity to grow and tend plants); ii) rural location away from cities and other pollution point sources and iii) the location of risk areas determined from the provisional risk assessment exercise. To aid the interpretation of study results, passive samplers would provide mean ambient ozone concentrations for two weekly periods at study sites. In addition, sites would either be located close to meteorological measurement stations or use micro-loggers to monitor temperature and relative humidity during the study period. The use of electrical samplers to monitor pollutant concentrations at selected sites if such equipment is available would also benefit interpretation of the results. The monitoring would in the first instance be run only for one year co-ordinated by SEI-Y with the first year activities being presented and discussed in a report synthesising the results and conclusions of the activity. It is hoped that the monitoring would be conducted for future years and expand to include a greater number of sites to build up a robust standardised air pollution damage database. Such continued monitoring would provide a focus to cement co-ordinated APINA activities to assess crop damage from air pollution and that this activity be supported by the eventual establishment of a southern African co-ordination centre. It is hoped that this activity would also be performed by NIAs involved in the Malé Declaration, hence providing the

unique opportunity to apply, compare and contrast standardised risk assessment methodologies in both South Asia and southern Africa.

It is worth noting that a range of experimental protocols would be developed within the APCEN, the bio-monitoring study has been identified as the most appropriate for use in the region to identify areas at risk and extent of crop yield losses. However, over the course of the first year activities APCEN might identify other methods (e.g. alternative active bio-monitoring, transect studies, fumigation/filtration studies) which the APINA members might feel would be more appropriate than those suggested above. In addition, the methods suggested are targeted at understanding the implications of ground level ozone for agricultural crops, the provisional risk assessment wouldl go some way towards identifying those locations where ozone is a perceived threat. It might be that alternative bio-monitoring campaigns should be applied in areas where ozone is perceived a low risk to agricultural productivity but where other point source pollutants e.g. SO_2, are thought to be of greater concern. For example, transect studies to investigate the sphere of influence of SO_2 from local emission sources might be more appropriate to apply in terms of estimating risk to agricultural productivity posed by air pollution.

2.7.2. Describe any deviation from original plan(s) and budget

The project has been delayed due to problems with the propagation of clover-clone bio-indicator plants at all southern African sites apart from South Africa. These problems are believed to have occurred due to the long transport time of the plant cuttings (shipment from Europe to Africa via express courier) and various unfavourable site-specific conditions such as extremely high temperatures in the greenhouse, fungi-infested substrate etc. Two batches of clover plants have been sent to Botswana, Mozambique, Tanzania and Zambia, as well as one batch to Zimbabwe, but all plants died on site. However, since South Africa (Potchefstroom) managed to establish the plants (see APCEN pilot study report) it will now function as a regional supply centre of clover cuttings for all other southern African countries. This should reduce the risk of failure of the cuttings due to the reduced transport time and prior adaptation to southern African conditions.

The budget has been affected due to the use of additional funds to fund the repeated shipment of cuttings as well as for the propagation and shipping of stock plants into and from Potchefstroom. APINA had also not budgeted for reimbursables and these had to be taken from the contingency fund.

2.7.3. Results, outcomes and deliverables

Very little research has been conducted previously in the southern African region to assess the impacts of air pollution on crops (van Tienhoven & Scholes, 2003). As such, this project makes a first attempt to establish a range of different assessment techniques and capacity build the skills to apply these across the region to enable the performance of standardised risk assessments. Within this project we focus on surface ozone since this is a pollutant capable of causing regional (as opposed to more local) impacts and whose concentrations across the southern African region are projected to increase by 7 ppb assuming a business as usual scenario over the next 20 years (Dentener *et al.*, 2006).

The **provisional risk assessment** for maize has been performed for southern Africa (van Tienhoven et al., 2006). This suggested that ozone levels are high enough to pose a potential threat to food production in the region. However, certain limitations of this study, (e.g. the use of European air

quality guidelines, the representation of monthly AOT40 values by modelled 5-day ozone concentrations) mean that the results are not absolutely conclusive. These uncertainties highlight the need to perform additional "ground truthing" studies such as bio-monitoring methods. Complementary research has been conducted in related projects that have arisen from this RAPIDC work, these include a START PACOM funded project to assess the relative yield losses from ozone and drought across the southern African region (Zunckel et al 2006) and an MSc project to assess the threat to food security in southern Africa (Badu, 2007). Both projects confirmed the potential for surface ozone to compromise food availability in the region.

The **bio-monitoring campaign**. A key achievement of this project has been to establish a bio-monitoring network to investigate the impacts of air pollution on crops in southern Africa. This network comprises a total of 13 members in 7 countries (Botswana, Malawi, Mozambique, South Africa, Tanzania, Zambia and Zimbabwe), which exceeds the original expectation and reflects the interest in this issue in the region. Network members were trained in the implementation of a clover-clone bio-monitoring method at a workshop in Potchefstroom (South Africa) in September 2006. This experiment was chosen for its simplicity and its previous successful use in Europe (Harmens et al., 2006) where it has been applied for the past 11 years under the auspices of the UNECE CLRTAP. As such, implementation of this standardised method allows not only an assessment of risk to be made within southern Africa but also between Africa and Europe (and south Asia since this method is also being applied under the Malé crops initiative). The bio-monitoring method has been successfully piloted in Potchefstroom, South Africa during the 2005/2006 growing season and is currently being repeated during the 2006/2007 growing season. Initial results showed that ozone levels in Potchefstroom were high enough to produce visible injury and biomass loss.

A synthesis of the entire RAPIDC crops project, both including this and previous phases, has been described in a book chapter currently in press (Emberson *et al.*, in press). This summary provides more detail as to how the different components of the Crop work (APINA, Malé and APCEN) combine together and complement research to assess crop impacts in the two specific regions and connect with ongoing research globally. Research focussing on the importance of the impact of air pollution in comparison with the impact of other environmental stresses (e.g. drought) on crop growth will become more important under the influence of climate change and should be considered in terms of the direction this work should take in the future.

Fig. 1 Visible injury (white rash of spots) on leaf of sensitive white clover clones (Smit, pers. comm.)

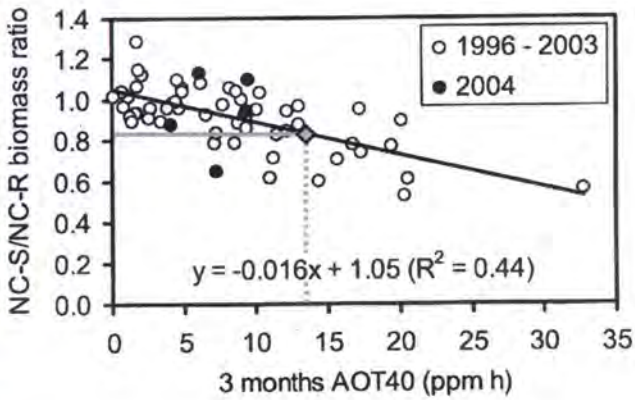

Fig. 2 Dose-response relationship for white-clover, the diamond indicates the sensitive/resistant biomass ratio from which the ambient AOT40 level has been estimated (Smit, pers. comm.)

References (those in bold are publications arising from the RAPIDC crops project)

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Zunckel, M., Emberson, L.D., Sowden, M. and Badu. (2006) Understanding the Relative Risk Posed to Agricultural Productivity by Air Pollution and Drought across the southern African Region CSIR Report number: CSIR/NRE/PW/ER/2006/161/C

2.7.4. Assessment and analysis of progress:

A. General information and context concerning the issue being addressed by the RAPIDC activity:

(i) What is the status of the issue in the relevant region? Due to the lack of and substantial evidence of crop effects by air pollution in the region this issue has had little attention by any relevant stakeholders (scientific, governmental and non-governmental) outside of the work that is ongoing in this RAPIDC programme. This programme will attempt to define the current day magnitude and geographical extent of the issue, and at the same time efforts have been ongoing to raise awareness through publications and presentations at different conferences / meetings / workshops e.g. the IGAC conference in Cape Town (South Africa) where the findings of the provisional risk assessment and bio-monitoring campaigns have been reported.

(ii) What are the capacity enhancement and assessment needs – institutions, activities and personnel and the importance of data quality etc?

The level of capacity to assess crop impacts from air pollution has been substantially increased in the region through the very successful training workshop held in Potchefstroom in September 2006.

Thirteen (13) scientists representing all APINA countries were trained in assessing the impacts of air pollutants on crops with a special focus on bio-monitoring methods.

(iii) Are there major trends for the issue in the region(s) that you can identify? No clear trends are evident as yet as this is an emerging issue.

(iv) For impacts, what are the prospects and progress of mitigation in the region(s)? It is too early to discuss mitigation options for the region.

(v) The significance of the regional approach – needs, advantages, data exchange, personal – professional linkages etc... A regional approach to this issue would be extremely important since surface ozone is a transboundary pollutant. As such, the implementation of any future mitigation strategies that may be required can only be managed by a joint approach of all APINA countries.

B. Specific information relating to your RAPIDC activity:

(i) How is the regional approach advancing the issue in the region? – what capacity is being built up and how does this relate to existing capacity?

The **provisional risk assessment** activity has been performed by scientists in the region (southern Africa). These scientists engaged with those in Europe to ensure appropriate application of the air quality standards (AOT40) used in the assessment. Capacity building here has also lead to new flux-based techniques to assessing ozone impacts, currently being developed in Europe, being incorporated in the chemical transformation model used for APINA air quality management. This work was performed in a related project (START PACOM) that compared the influences of drought and ozone exposure on crop yield for southern Africa.

The **bio-monitoring activity** has resulted in 13 scientists representing all APINA countries being trained in the clover-clone protocol, and introduced to the EDU methods (see APCEN report), at a workshop held in Potchefstroom, South Africa. The clover-clone protocol will be re-tried in 5 countries (Botswana, Mozambique, Tanzania, Zambia and Zimbabwe) for one growing season; this will now be the 2007/08 growing season when the problems of survival of live clover-clone cuttings should be overcome. This network is largely comprised of experts in agricultural science. As such, the training in air pollution impact assessment provides an additional and complementary area of expertise to this professional body.

(ii) What is the significance of the project and its progress to the issue of air pollution in the region? *For example, if it is an impacts activity – how does it relate to the sum total of impacts related activity in the region? Or how does the monitoring relate to other on-going monitoring? If it is policy related – how does it relate to overall policy development in the region? etc....*

The establishment of the bio-monitoring network has been important in bringing together scientists from across the region. The bio-monitoring protocol provides a common focus for these scientists, which if continued in future years, would provide a continued opportunity to meet and discuss results. Such an active network could then develop new strategies for assessing, emerging stresses to agriculture including important agricultural crops and sensitive ecosystems in the region in connection with air pollution issues. As such, we see the initial establishment and development of the network as providing a solid foundation for future activities that the regions can drive forward themselves as appropriate given the multiple stresses facing agriculture.

C. In addition, could you add:

(i) a paragraph on your project that you might put in a press release; To date it is unclear whether surface ozone pollution may be a significant factor compromising current food availability in the southern African region. Provisional risk assessments suggest that surface ozone concentrations are high enough to be causing damage, though these assessments are based on European air quality guidelines and are limited in terms of their evaluation to predict real effects on the ground. In an attempt to fill this knowledge gap the RAPIDC crops project has established and trained a network of scientists across the southern African region to perform co-ordinated experiments to assess the real impacts of surface ozone. Such a network may prove invaluable if pollutant levels are found to be capable of damaging crops and compromising food availability, especially given the multiple stresses acting on agriculture in the Southern African region that are only likely to worsen in the future under climate change conditions. Such conditions are likely to influence crops sensitivity to pollution and therefore should be considered in future crop pollutant impact studies.

(ii) a summary of substantive progress; See above

(iii) any interaction with the region in terms of help 'in kind' and financial assistance; Some APINA countries expressed their interest to carry out further air pollution impact assessment studies using EDU; however, additional funds need to be found to realise this goal. In general all collaborators are very much dependent on the RAPIDC funds so far, although funding has been forthcoming from South Africa for the CAPIA (Cross-border Air Pollution Impact Assessment) project that grew from APINA activities in the region.

(iv) progress on capacity building and ownership detailing prospects for sustainability of built capacity;

The chemical transfer model (CAMx), based and run from CSIR, South Africa, has been updated with a revised deposition module that is capable of estimating both ozone deposition and impacts to a key crop in southern Africa. Ideally, the module would be parameterised for additional local vegetation types to provide improved estimates of deposition across the region.

The team at Potchefstroom, South Africa is now acting as a regional co-ordination centre through the propagation and delivery to other countries in the region of stock clover-clone plants and through the on-site manufacture of EDU (see ACPEN report). This means that future bio-monitoring activities will not be dependant on support from Europe.

(v) major problems/ set backs;

Problems in establishing live clover-clones at the bio-monitoring sites. We believe the long transport times and harsh conditions the plants experience during transport weaken the plants making them unable to acclimatise once they arrive at the location. This was one of the risks of failure stated in the proposal but the supply of clover-clones now being provided from within the region (i.e. South Africa) should negate this problem.

(vi) recommendations for improvements; continued funding for future years and incorporation of assessment of additional stresses, especially those stresses related to climate change (e.g. drought, temperature stress) which will interact with pollution impacts

2.7.5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally *e.g. north –south and south –south linkages etc*

The project has links with the following bodies:-

- *north- south,* ICP Vegetation and UNECE CLRTAP (bio-monitoring)
- *south – south,* RAPIDC Malé Declaration links (bio-monitoring)
- *north- south,* UNECE CLRTAP (use of critical levels in provisional risk assessment)
- *international,l* APCEN Network (providing support and technical advice for risk assessment and bio-monitoring)

2.7.6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

The clover bio-monitoring experiment will be carried out in all countries during the 2007/08 growing season but ideally would be continued for additional future years as we have really only now established the network. The site at Potchefstroom, South Africa is taking on the role of a regional technical support centre; this is intended to provide a focus for the handover of the programme to the regions.

2.7.7. Gender, poverty and HIV/Aids issues relevant to project

No comment

2.7.8. Any other relevant comments/grievances etc

None

LFA 2.8: Strengthen knowledge on impacts of air pollution on natural ecosystems

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: Strengthen knowledge on impacts of air pollution on natural ecosystems	**Project Number:** 731285
Lead institution: Institution: University of Malawi, Chancellor College **Principal Contact:** Mrs Meya Kalindekafe **Contact Details:** P.O. Box 280, Zomba. Malawi **Phone:** +265 1 524222/265 8 896625/ 265 1 526346, Fax: 265 1 524046 **E-mail:** lkalindekafe@chanco.unima.mw or meykalinde@yahoo.co.uk	**Prepared by:** TTL Mrs Meya Kalindekafe (Task team Leader)

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2.8.1. Outline of original project

This activity will identify sensitive ecosystems in southern Africa potentially impacted by air pollution. The scoping study conducted by CSIR in Phase II reported that damage from air pollution to natural ecosystems in southern Africa is likely, but evidence in the form of plant damage or ecosystem changes is not apparent. In all countries, apart from South Africa, very little work has been done on air pollution impacts to natural ecosystems. Even in South Africa, where the majority of studies have been conducted, research efforts are sporadic and uncoordinated.

Southern African vegetation shows little evidence of either direct effects of gaseous pollution or indirect, soil-mediated impacts, in any of the countries studied thus far. As evidence from Europe and elsewhere has shown southern Africa cannot afford to be complacent with respect to air pollution

impacts. Proactive measures to identify potential problem areas need to be implemented immediately in order to mitigate or prevent air pollution while striving for equitable development across the region.

Technical support for studies on the potential impact of air pollution on natural ecosystems was given the fifth highest priority in the questionnaire survey and APINA members at the Tanzania meeting were concerned that some unique ecosystems could be at risk in the region. As funding traditionally goes to areas most likely to attract the attention of policy makers, such as public health and food security, APINA is interested to fund activities in this area. To ensure their success, activities on natural ecosystems during Phase III would develop from a consultation process based around the expert and crop impact workshops planned for Phase III. Developing studies in this way would ensure that any future APINA projects are well thought out and have support from the key stakeholders in the region.

APINA needs to nominate appropriate institutions or individuals to carry out work on impacts of air pollution on ecosystems. A team to assist in this work would then be constituted based on interest and capacity. The nominated Task Team Leader would attend the experts workshop (Activity 2.1) to develop linkages with other Task Teams as well as attend a workshop in collaboration with the crops task team (Activity 2.7). The Task Team would investigate potential studies to identify sensitive ecosystems in southern Africa which may be impacted by air pollution.

2.8.2. Describe any deviation from original plan(s) and budget (with reference to current financial statement)

The scoping report and proposal were supposed to be submitted in September 2006. Since we had a change of TTL after the Start up workshop, the new TTL had to attend the crops workshop and the Annual APINA meeting both of which took place in September 2006 to enable her to meet other TTLs and network with the crops TTMs.

2.8.3. Results, outcomes and deliverables

The TTL attended both the Crops workshop and Annual APINA meeting held in September 2006. The scoping report incorporating a proposal for Phase IV activities has been drafted.

2.8.4. Assessment and analysis of progress:

***A. General information and context concerning the issue being addressed by the RAPIDC activity*:**

The major problem to be tackled is that the current extent and impact of air pollution on natural ecosystems, especially biodiversity hotspots in Southern Africa, is poorly understood and the future development of these problems, including the required policy responses, is unclear. There is also little scientific capacity to address the challenges facing natural ecosystems that are caused by air pollution in southern Africa, as most scientific attention is focussed on issues of crop production and food security.

(ii) What are the capacity enhancement and assessment needs – institutions, activities and personnel and the importance of data quality etc?

There is need for training of experts in the region on air pollution impact on natural ecosystems. Institutions need to be strengthened in terms of equipment for monitoring. There is also need to enhance training at postgraduate level in most participating countries on issues related to air pollution

impacts on ecosystems. Specifically, a manual needs to be developed that will provide country experts with methods to assess ecosystem impacts from air pollution in the following areas:

- ✓ Air Pollution Impact Assessment Methodologies – (e.g. observational, experimental tools). To come up with methods that are relevant and will be used for regional assessment linking deposition estimates with ecosystem sensitivity to certain impacts. (a) biochemical measures of nitrogen accumulation (e.g. amino acid levels in leaves), b) measures of species composition of different components and c) methods involving the transplanting of live plant material.
- ✓ How to monitor for impacts of air pollution on different ecosystems (terrestrial, aquatic, soil) and their components (different species and physiochemical factors)
- ✓ Risk assessment procedures used for different air pollutants on different ecosystems (including differentiating pollution effects from other effects)
- ✓ Regional assessment methods linking deposition estimates with ecosystem sensitivity to certain impacts
- ✓ Use meteorological, emissions and deposition data to assess impacts on ecosystem

(iii) Are there major trends for the issue in the region(s) that you can identify?

NA, because the study has not been carried out.

(iv) For impacts, what are the prospects and progress of mitigation in the region(s)?

NA, because the study has not been carried out.

(v) The significance of the regional approach – needs, advantages, data exchange, personal – professional linkages etc

Since air pollution is not confined to national boundaries, it is important that the impacts on ecosystems should be approached from a regional perspective to create a database which countries can use. With very few countries having some capacity in the issue, linkages at all levels are a must.

B. Specific information relating to your RAPIDC activity:

(i) How is the regional approach advancing the issue in the region? – what capacity is being built up and how does this relate to existing capacity?

It is difficult to make an assessment of the regional capacity at this stage because the activity is only at proposal level. However, countries such as South Africa are advanced in terms of documented research on air pollution and impacts on ecosystems.

(i) What is the significance of the project and its progress to the issue of air pollution in the region? For example, if it is an impacts activity – how does it relate to the sum total of impacts related activity in the region? Or how does the monitoring relate to other on-going monitoring? If it is policy related – how does it relate to overall policy development in the region? Etc.

This activity is important because humankind relies on ecosystems for their livelihoods and knowing what impacts air pollution has on ecosystems will enable countries to come up with prevention and mitigation measures that will ensure continued accrual of benefits from these systems.

C. In addition, could you add:

(i) a paragraph on your project that you might put in a press release;

Despite the growing air pollution problem in Southern Africa, air pollution studies are scarce and largely concerned with impacts on human health. Impacts on natural ecosystems are largely ignored

as there is a lack of urgency concerning the need to understand the consequences of air pollution on these systems. Yet human health, welfare and prospects for sustainable development are undeniably dependent on healthy ecosystems. People's livelihoods are linked to ecosystems through their dependency on marketable commodities such as food, medicine, timber, pulp, fuel, fishing, hunting, bird watching, ecotourism etc and non market goods and services such as environmental modulation, ecological roles, knowledge, aesthetic values and existence values/intrinsic value. It is for this reason that a proposal is being developed by theAPINA to look at how key sensitive ecosystems are / will be affected by air pollution.

(ii) a summary of substantive progress;

- ✓ Task Team Leader attended the Crops Ozone Biomonitoring Training in September 2006.
- ✓ Attended APINA annual meeting in Cape Town in September 2006.
- ✓ Developed a questionnaire aimed at soliciting key issues affecting ecosystems in Southern Africa.
- ✓ Drafted the proposal for future activities for the Ecosystems Task Team.
- ✓ Key personnel to participate have been identified in some countries.

(iii) any interaction with the region in terms of help 'in kind' and financial assistance;

NA, but proposal to be presented for APINA Phase IV funding and other sources of funding will be sought.

(iv) progress on capacity building and ownership detailing prospects for sustainability of built capacity;

- The Task team Leader attended a crops biomonitoring training workshop in South Africa and will share this information with her task team as it develops.
- The TTL attended the Decision Support Workshop in Tanzania in April 2007.

(v) major problems/ set backs;

In trying to achieve the intended objectives, two major challenges were faced by the task team leader namely poor response from country representatives and lack of funding for the activity.

It was very difficult to obtain information from respective countries on what ecosystems exist in APINA participating countries and key issues affecting these ecosystems. However those that responded provided very valuable information for the proposal.

(vi) recommendations for improvements

There is need to bring experts together to brainstorm on key issues affecting ecosystems in Southern Africa

2.8.5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally: e.g. north –south and south –south linkages etc

Trying to link up with the biodiversity and climate change study groups within the region and also to write to universities within the region and see initiatives on the issue. Specifically this task team will try to link up with Theo Fischer who works on lichens as biomonitors, Prof Gert Kruger on entomological work and contacts have already been made with Micky Josopovic who is working on estimate of sensitivity of the local (regional) ecosystems to acidification.

2.8.6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

To finalise the proposal and submit to IES and form a Task Team ..

Plans for the next phase are:

1. Identification of Ecosystems Task Team members with expertise in different ecosystems.
2. Hold Ecosystems Team workshop 1 to discuss the specific issues affecting ecosystems and studies to be carried out for key ecosystems that are regionally relevant so that all country participants can get involved. Focused key issues such as regional ozone, nitrogen and sulphur deposition, or heavy metal deposition will be identified.
3. Build capacity of team members through training in monitoring of impacts of air pollution on ecosystems – technical assistance will be needed.
4. Conducting Studies on Impacts of Air Pollution on Ecosystems in selected countries where information on key ecosystems is available.
5. Participating countries present findings at a workshop 2.
6. Write and submit the Ecosystems Task Team Report.
7. Continue collaboration with other Task Teams and initiatives.

2.8.7. Gender, poverty and HIV/Aids issues relevant to project

As stated above, ecosystems provide most of the basic livelihoods needs for people in Southern Africa. Different gender groups play different roles when it comes to access, control and use of natural resources. Any serious air pollution impacts to the ecosystems that support these natural resources will also have an effect on the access, control and use of these resources. In terms of HIV/AIDS, nutritional status of individuals is critical, and similarly any impact to ecosystems is a concern to HIV/AIDS.

2.8.8. Any other relevant comments/grievances etc

Ecosystem are a critical part of the environment and therefore adequate resources need to be allocated to this activity.

LFA 2.9: Strengthen knowledge on impacts of air pollution on Corrosion

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: Assess corrosion at sites using exposure of standard samples.	**Project Number:** N/A
Lead institution: University of Zambia, Department of Metallurgy and Mineral Processing, PO BOX 32379, Lusaka, Zambia **Phone**: (+260-1) 295174, 294086 **Mobile**: (+260-96) 954007 **E-mail**: clungu@mines.unza.zm, metalmins@yahoo.com	**Prepared by:** LUNGU Chozi Vincent, Mr. (Task Team Leader)

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2.9 Outline of original project

This activity comprises of three sub-activities, namely assessment of corrosion at sites using exposure of standard samples; demonstration of corrosion risks using Rapid Corrosion Assessment Kits; and training in 'stock at risk' and economic assessment of corrosion damage

2.9.1. During the consultation there was considerable interest in the corrosion studies as there is little knowledge about the potential impacts in Southern Africa. At the Tanzanian meeting there was a recommendation for adding two new corrosion exposure sites in addition to the four existing ones (South Africa (urban), Zambia (urban and rural), Zimbabwe (urban)) to include Tanzania and Mozambique (coastal sites). The Task Team Leader for corrosion visited the proposed site in Tanzania and confirmed its suitability to participate in APINA activities.

Standard materials would be exposed in order to determine the rate of corrosion and its relation to environmental parameters. Samples would be set up for exposure periods of 1, 2 and 4 years but only evaluation of 1-year corrosion samples could be performed within the present project period. The budget allows for two sites, one site in Tanzania and one in Mozambique, to be added in addition to the existing four APINA sites in southern Africa. The tasks are:

- Participation of potential African partners in the "workshop and training course on evaluation of corrosion attack on materials samples" (CORNET sub-activity 1.1.1)
- Selection and contract negotiations with African partners to be responsible for the maintenance of the new test sites.
- Preparation and shipping of materials samples and racks to the test sites or alternatively use of local material for production of rack.
- Training, selection of site location and installation (start of exposure) during site visit.
- Passive sampling of SO_2, NO_2, O_3, HNO_3 and particulate matter during the 1st year of exposure on a bi-monthly basis at each test site.
- Collection of environmental data (temperature, relative humidity, amount of precipitation and pH of precipitation) during the 1st year of exposure on a monthly basis at each test site.
- Evaluation of corrosion attack after 1 year of exposure involving photographic records (carbon steel, zinc, copper and paint coating), weight change (carbon steel, zinc, copper and limestone), mass loss (carbon steel, zinc and copper) and damage from cut (paint coating).
- Analysis of results and presentation by TTL at APINA annual meetings and the second CORNET meeting.

2.9.2 The standard racks used in 2.9.1 are designed and located with the aim of providing a general corrosion value that is affected to a limited extent by the presence of surrounding buildings and other objects. In a real environment it is also important to know the possible levels of corrosion attack including the variability over a region. The idea, which has support from some countries, is to use rapid corrosion kits as indicators of corrosion occurring within an urban area. Kits would be shipped to cities containing material samples for exposure. Samples would be placed at up to ten locations in different parts of a city: e.g. one in the city centre, industrial area, road side, commercial area, culturally important area, suburban area and in rural location outside the city. This activity would need to be carried out in conjunction with sub-activity 2.9.3 on stock at risk and economic assessment of damage detailed below. The potential for a kit study and a detailed stock at risk study in southern Africa will be explored at the expert workshop (Activity 2.1) and APINA members would be invited to the training workshops held in connection with the CORNET meetings. A feasibility study would be conducted by the TTL to determine if the capacity and data required are available in the region.

2.9.3 To make an economic assessment of the extent of corrosion damage is of high importance since it is a necessary input to a cost-benefit analysis. This makes it possible for decision-makers to make rational decisions and to weigh actions taken for the benefit of materials and cultural heritage against measures specifically targeted to other areas. As mentioned elsewhere one necessary element for the cost calculations is the development of dose-response functions and this is addressed in APINA sub-activity 2.9.1 and CORNET activity 1.2. Another necessary element for the cost calculations is to know where buildings/objects are located and what materials are included in the buildings/objects. This is addressed in this sub-activity and is called to assess the stock of materials at risk.

Until there is a decision on the extent of APINA corrosion activities during Phase III, there is only one task which will be undertaken: training of all partners at a workshop for stock at risk and economic assessment held in connection with the second CORNET meeting in South Asia.

2.9.2. Describe any deviation from original plan(s) and budget *(with reference to current financial statement)*

The exposure of materials at the four sites in the region in the first four years was followed according to set goals. The workshop held in Bangkok, Thailand, for all RAPIDC sites during October 2006 enabled the APINA group to undertake a local corrosion evaluation exercise during February 2007 in Kitwe, Zambia. The Kitwe workshop that had participants from South Africa, Tanzania, Zambia and Zimbabwe had not originally been planned for and therefore used contingency funds after an agreement with the APINA Secretariat.

2.9.3. Results, outcomes and deliverables

Refer to publications, book contributions, graphs, tables and raw data (using annexes where appropriate).

In addition to year 1 results (Annual Report 2006), year 2 mass loss results were worked out for all exposed samples in the programme. Further, one year trend results for the period ending August/September 2006 have also been evaluated (Kitwe workshop report). Results for the original APINA sites in South Africa, Zambia and Zimbabwe are now available.

Contributions to publications have included the "**Corrosion impacts of air pollution in developing countries**" in the Air, Water and Soil Pollution Journal (Dec., 2006).

Table 1: RAPIDC Year 2 Exposure Results for Southern Africa

Site	Carbon Steel (g/m²)		Zinc (g/m²)		Copper (g/m²)	
	1	2	1	2	1	2
15 Johannesburg	163.68	173.16	4.0994	4.4661	8.30857	9.58952
16 Kitwe	559.85	561.53	47.0980	47.9933	18.87714	19.69833
17 Magoye	73.03	67.88	3.2128	3.4417	9.99476	10.34762
18 Harare	265.49	268.06	6.1489	6.4637	7.52444	7.61952

Table 2: RAPIDC Two Year Exposure Results for Southern Africa cont'd

Site	Painted steel (mm damage from cut)			Portland limestone (weight loss µm)		
	1	2	3	1	2	3
15 Johannesburg	1.035	1.79	2.07	Missing	Missing	Missing
16 Kitwe	4.28	3.86	4.335	9.02	9.49	10.56
17 Magoye	3.07	4.58	5.14	60.63	61.38	61.47
18 Harare	1.68	1.82	2.32	14.51	Missing	Missing

2.9.4. Assessment and analysis of progress:

A. General information and context concerning the issue being addressed by the RAPIDC activity:

(i) What is the status of the issue in the relevant region?

- *How important to impacts?*
  - *How important is it politically?*
  - *What is the awareness of the issue?*
  - *Has there been a change in awareness/relevance of the issue in the region(s) in the last ten years?*
  - *What is the knowledge about this issue in the region? i.e. how would you describe the current level of understanding of the issue in the region(s) and what gaps remain to be filled?*
  - *What is the level of capacity to study this issue in the region?*

The issue of air pollution is still not receiving the desired political support as its appreciation is mainly at abstract level. The general public equally has low appreciation and awareness as corrosion impacts have low media coverage and general debate. While legislation and regulations may have improved somewhat in the last decade they have not really translated to impact on the public.

As is the case with issues of water pollution and related subjects, there is significant local capacity to study and improve understanding of air pollution and related impacts. Support is however required on standardisation of procedures and methods as well as making available relevant equipment and materials.

(ii) What are the capacity enhancement and assessment needs – institutions, activities and personnel and the importance of data quality etc?

The corrosion group should over time support the development of a centre of excellence for the region in corrosion assessment. There is need to improvement equipment and availability of literature.

(iii) Are there major trends for the issue in the region(s) that you can identify?

Recently observed foreign direct investment (FDI) in the major economic sectors such as mining for Zambia will require pertinent information and data on suitable materials for infrastructure development (and corrosion aspects will be important here).

(iv) *For impacts, what are the prospects and progress of mitigation in the region(s)?*

This aspect is dependant on accurate data. With the development of corrosion maps from the on going exposure experiments, users of various construction materials will be more aware of the nature of the environments they operate in and policy makers will also have an opportunity to incorporate

incentives in the procurement of materials for construction, as well as important information to to inform mitigation options.

(v) *The significance of the regional approach – needs, advantages, data exchange, personal – professional linkages etc*

At the last corrosion workshop on evaluation (Kitwe, February 2007), knowledge on other ongoing activities and initiatives was shared and possibilities for finding solutions to corrosion problems within region were discussed.

B. Specific information relating to your RAPIDC activity:

(i) How is the regional approach advancing the issue in the region? – what capacity is being built up and how does this relate to existing capacity?

As suggested above in (v), two countries that came on board in September 2006, Mozambique and Tanzania, gained advance knowledge on evaluation before any of their exposed specimens were due for assessment. The two countries and their participants therefore acquired the skills and knowledge beforehand and that should be considered an advantage.

(ii) What is the significance of the project and its progress to the issue of air pollution in the region? For example, if it is an impacts activity – how does it relate to the sum total of impacts related activity in the region? Or how does the monitoring relate to other on-going monitoring? If it is policy related – how does it relate to overall policy development in the region? Etc.

As one of the key outputs is data on economic costs of atmospheric corrosion (as related to pollutant gases), it should add significantly to the case for policy and legislative framework development for the region.

C. In addition, could you add:

(i) a paragraph on your project that you might put in a press release;

The first phase of the corrosion impacts of air pollution exposure experiments in southern Africa came to a close in September 2006. Initial findings based on five selected material types show that there are significant differences of corrosion attack as a result of different pollution levels. Individual materials are affected by different pollution parameters and their combinations.

Based on dose response functions developed in Europe, the measured corrosion values are lower than expected for zinc and higher than expected for limestone. Sulphur dioxide pollution was found to be the most decisive factor. A correlation to pH was noted for zinc and limestone just as a correlation to HNO_3 was noted for limestone alone.

(ii) a summary of substantive progress;

In addition to what is noted in (i) above, regional capacity in evaluation of corrosion materials received a boost by conducting a joint workshop (Kitwe, Zambia, February 2007) task team members from all the participating countries in the APINA project. Substantial amounts of data on climate, environment and corrosivity for the selected areas for exposure have been collected and will form the initial data base.

(iii) any interaction with the region in terms of help 'in kind' and financial assistance;

This has been slow and in the last four years nothing significant has been forthcoming.

(iv) progress on capacity building and ownership detailing prospects for sustainability of built capacity;

Last two workshops for the corrosion group at global and regional levels (October 2006 and February 2007) significantly contributed to capacity building and further opportunities should be explored.

major problems/ set backs;

Local financing of the programmes should compliment the effort shown by the RAPIDC initiative and provide sustainability. At present that is lacking but the Task Team is working to improve this situation.

(vi) recommendations for improvements

All should work towards incorporating local financing initiatives as suggested in (iv) above.

2.9.5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

e.g. north –south and south –south linkages etc

Corrosion network (CORNET) activities, the first of which was the Bangkok, Thailand, corrosion evaluation training workshop in October 2006, where African and Asia participants met and exchanged information and ideas.

2.9.6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

To continue with passive sampler and metal exposures at the two new sites at Dar-es-Salaam, Tanzania and Maputo, Mozambique. The old four sites were decommissioned in July/August 2006. Feasibilities for stock at risk assessments are now due in all participating countries and that shall be a key input for the Rapid Urban Assessment (RUA) being led by Mozambique.

2.9.7. Gender, poverty and HIV/Aids issues relevant to project

At present project and programmes confined to institutions and largely represented by APINA researchers. Issues of gender, poverty and HIV/AIDS will be more relevant when the phases on stock at risk and RUA are tackled.

2.9.8. Any other relevant comments/grievances etc

None.

LFA 3.1: Provide decision support information for policy formulation and mitigation

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April/2007
Project Title: 3.1 to 3.3 Provide decision support information for policy formulation and mitigation	**Project Number:** 731315
Lead institutions: Institute of Environmental Studies, Zimbabwe and University of Zambia.	**Prepared by:** RAPIDC Co-ordinators for APINA, Stephen Simukanga and Sara Feresu

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3.1.1 Outline of original project

The questionnaire survey conducted during the consultation phase gave technical assistance on mitigation options for southern Africa the third highest priority after health and emissions inventory activities. The consultation process highlighted the need for all APINA activities to be linked to control, mitigation, harmonisation and socio-economic issues through Task Team interaction. This would be another important aspect for the expert workshop at the start of Phase III to consider. These synergies would also be fostered through national and regional joint meetings and communication through the Internet etc. The consultation process also identified capacity building needs in:

(i) Training in cost-benefit analysis;

(ii) Harmonisation and coordination through the SADC regional body

Three sub-activities were detailed in the proposal that would conduct scoping studies on:

(i) legislation options;

(ii) control and mitigation options;

(iii) socio-economic issues.

Funds for attendance of a joint workshop by the TTL of each task team were also made available.

3.1.2 Describe any deviation from original plan(s) and budget

- The scoping studies for the three areas are currently being compiled and are behind schedule. The main reason for the delay is that this is a new area of activity for APINA and the capacity and networking in the region is at an early stage of development.

The original idea in the proposal was for funds to be provided for 5 members of each task team to attend a joint workshop. However, since task teams have not been formed due to limited funds, the workshop was redesigned to include the TTLs of all APINA activities and the National Focal Points (NFPs) from the Ministries of Environment of each of the APINA affiliated countries.

3.1.3. Results, outcomes and deliverables

Legislation options by TTL for Harmonising Regulatory Tools based at Eduardo Mondlane University

The existing legislation on air pollution issues in the southern Africa has been documented by several APINA activities (e.g. see Table 1 in APINA Activity 2.3 on Monitoring). This information is currently being synthesised and reviewed in the writing of the scoping report.

Socio-economic issues by TTL based at University of Zimbabwe

A scoping study report on socio-economic issues related to air pollution issues in Southern Africa is currently being compiled in close consultation with the APINA Secretariat, SEI and IIIEE.

Control and Mitigation Options by TTL based at Sustainable Cities Programme, Tanzania

A scoping report on Control and Mitigation options has new been submitted and is being reviewed by the APINA Secretariat.

The TTLs will be supplied with relevant information and literature by IIIEE who are conducting capacity building on these issues for the Malé Declaration in South Asia as well as for APINA. For example, two major project deliverables for the Malé Declaration will also be distributed to the APINA group in order to support their work as much of the Asian context is valid for Africa:

- Policy case study manual: Policy Options for Air Pollution Prevention and Control in South Asia;

Development of Emission Scenario background and procedure manual: Manual for the Development of Emission Scenarios for Air Pollution Prevention and Control in South Asia.

A joint workshop recently took place in April 2007 in Dar-es-Salaam, Tanzania. The workshop was well attended by APINA TTLs and NFPs from the seven participating countries (Botswana, Malawi, Mozambique, South Africa, Tanzania, Zambia, Zimbabwe) and all Tanzanian task team members of APINA activities who are resident in Dar es Salam , the ACR for Tanzania as well as participants from various interested institutes in Tanzania e.g. a representative of the Dar-es-Salaam Bus Rapid Transit project who also presented at the workshop.. The workshop was facilitated by IIIEE ,SEI and the APINA secretariat and produced recommendations on how the APINA regional policy dialogue

scheduled for early 2008 can be designed to effectively engage relevant policy makers. Key conclusions were that:

a. The convening power of UNEP, which led to Ministerial attendance and the subsequent success of the BAQ Conference for SSA Cities in 2006 and paossibly from the SADC secretariat , should be harnessed if possible by APINA for the 2008 policy dialogue;

b. The APINA National Stakeholder Meetings planned for May – July 2007 in each country should be carefully planned so that they engage the appropriate stakeholders (including representatives from all relevant Ministries, not just the Environment Ministries) who can then identify the main air pollution impacts of concern and control and prevention issues in each country;

c. Conclusions of all relevant APINA activities, especially the results of the national stakeholder meetings, should be reported to the NFPs at the Ministries of Environment as soon as possible so that the Permanent Secretaries (and ultimately Ministers) can be briefed well in advance of policy dialogues.

Full proceedings from this workshop are currently being compiled.

3.1.4. Assessment and analysis of progress:

***A. General information and context concerning the issue being addressed by the RAPIDC activity*:**

(i) What is the status of the issue in the relevant region?

- How important to impacts?
- How important is it politically?
- What is the awareness of the issue?
- Has there been a change in awareness/relevance of the issue in the region(s) in the last ten years?
- What is the knowledge about this issue in the region? i.e. how would you describe the current level of understanding of the issue in the region(s) and what gaps remain to be filled?
- What is the level of capacity to study this issue in the region?

Status of the issue in the SADC region

Air pollution is becoming an increasingly important environmental problem in the southern Africa region. This is so because of the increased level of pollution caused by industrialization, inappropriate technologies used and increase in population in the region. Air pollution has a number of impacts on the human health, environment, climate change, agriculture, soils, and the built structures. n, Thus the issue of air pollution control and mitigation is seen as a very important issue both by the people and political leaders. Furthermore, the impacts of the air pollution have aroused great awareness of the people and governments in the SADC region. This awareness has greatly increased in the last ten years. Governments have seen the relevance of the air pollution and mitigation issue leading them to come up with various strategies of addressing it. People have been asked to take measures to prevent air pollution through undertaking environmentally friendly initiatives such as using unleaded petrol, clean indoor sources of energy. Cleaner production technologies are being widely encouraged. For instance industrial processes that release artificial chemicals such as halocarbons (CFCs, HFCs, PFCs)

and other long-lived gases like sulphul hexafluoride (SF6) which are responsible for greenhouse gases in the atmosphere, are highly being discouraged.

However, there are some knowledge gaps to be filled. These include the availing of detailed information on the current generation of various air pollutants from the different sources and their direct linkages to the human health; mitigation measures required and provision of affordable alternative sources of clean energy.

Despite the need for detailed air pollution related information, capacity to carry out inventories and studies is the major bottleneck. Most countries in the region are reported to have inadequate human and financial resources as well as equipment to tackle air pollution issues..

(ii) What are the capacity enhancement and assessment needs – institutions, activities and personnel and the importance of data quality etc?

There is a need to promote the training on air pollution issues in Southern Africa. Local governments need to be empowered to monitor air pollution and to provide the data to researchers so that the issue can receive attention. Accurate and up-to-date information is crucial for planning and informed decision-making. So far there has not been any project implemented on the Mitigation and Control issue. *Capacity enhancement and assessment needs*

In order to build capacities in the region, countries should come up with systematically planned enhancement plans and assessed needs that will cover the institutions to be involved, activities to be undertaken and the type of personnel to be trained .

Institutions and personnel

- In the first place countries should designate lead institutions that will be responsible for air pollution activities. Capacities of these institutions should then be assessed .

Activities

Countries should be encouraged to :

- Develop a broad sustainable national air quality management programme and strategy.
- Raise awareness among decision-makers and the public in general with respect to air pollution issues.
- Provide legal guidance (Develop regulations on air quality standards).
- Prepare site-specific standard operating procedures (for operation in the field and laboratory) to be followed in order to ensure that accurate and precise data are collected and analyzed.
- Develop Systems/protocols for communication providing/submitting relevant reports, evaluation and easy accessibility of information at various levels (level of confidentiality).

(iii) Are there major trends for the issue in the region(s) that you can identify?

Major trends in the region are emerging. These range from increased public awareness to enactment of air pollution related laws and regulations. Many countries have now come up with air pollution legislation and regulations. A few are preparing mitigation strategies in addition to initiating air pollution inventory and monitoring activities. For instance in Tanzania, an "Air quality monitoring capacity building project" has been established in Dar es Salaam city with assistance from USAID.

USEPA and UNEP. The project will be driven by the decisions of in-country stakeholders and ensure transparency with respect to decision-making and accessibility of the air quality data collected through the project.

(iv) For impacts, what are the prospects and progress of mitigation in the region(s)?

The legislation governing the control of air pollution is presently too weak to deter emission of pollutants. There are no incentives offered to major polluters to adopt mitigation measures.

Although no concrete information has recently been gathered from the countries in the region, one can safely say that there are high prospects for mitigating the air pollution impacts. Many countries have felt in one way or the other the impacts of air pollution. This has awakened them to even align themselves with international protocols such as ratifying Multilateral Environmental Agreements (MEAs). For instance many countries in the region have ratified the United Nations Framework Convention on Climate Change.

The mitigation process has slowly been increasing as countries have been able to come up with various initiatives that include:

- Carrying out inventory of greenhouse gases and other air pollution pollutants
- Introduction and/or strengthening of the application of Cleaner Technologies of production
- Preparation of papers/policies on Renewable Energy and Clean Energy Development
- Formulating National Transport Policies that aim at achieving sustainable development in the transport sector by minimising the energy usage and environmental impact of the transport sector.
- Preparation of Papers on Integrated Pollution and Waste Management that represent a paradigm shift in the approach to pollution and waste management with the focus on pollution prevention rather than impact management
- The use of refined (unleaded) fuel and the production of synthetic fuel (bio fuel, etc)

(v) The significance of the regional approach – needs, advantages, data exchange, personal – professional linkages etc

Regional approach to dealing with air pollution is of significant importance as it facilitates the preparation of integrated policies and strategies on the issue. Under this approach, the results of country assessments can be used to improve understanding of the ancillary benefits of mitigation and to develop integrated local and regional air pollution control strategies.

B. Specific information relating to your RAPIDC activity:

(i) How is the regional approach advancing the issue in the region? – what capacity is being built up and how does this relate to existing capacity?

It is not cost effective to carry out a cost-benefit analysis of mitigation air pollution for individual countries within Southern Africa. A regional approach to the issue will be appropriate. Two or three experts can be selected to carryout the cost-benefit analysis which will be applicable to the whole of southern Africa.

(ii) What is the significance of the project and its progress to the issue of air pollution in the region? For example, if it is an impacts activity – how does it relate to the sum total of impacts related activity in the region? Or how does the monitoring relate to other on-going monitoring? If it is policy related – how does it relate to overall policy development in the region? Etc.

The TTLs for this activity have had problem in obtaining information form the NFPs and ACRs in the APINA countries. This is in part because relevant information is scarce but more importantly APINA NFPs and ACRs are often working as non-funded volunteers and find it difficult to answer additional requests for information on top of what they are funded to do. This is a general problem common to all APINA activities and hampers progress. This issue has been with APINA since its inception in 1998 but as more individual activities have received funding the situation has improved. The area of decision support is now a key area for APINA to obtain further funding to increase the effectiveness of its activities in this crucial area.

C. In addition, could you add:

(i) a paragraph on your project that you might put in a press release;

Air pollution is currently not seen as a very serious problem in the Sub Saharan countries when compared to other countries in the world simply because there is inadequate data and monitoring information. However, the pollution problem has been increasing over the years especially when individual pollutants are considered. This situation is going to have detrimental impacts on the human health and the environment with unprecedented socio-economic effects if left unchecked.

In order to tackle the problems associated with air pollution, accurate and up-to-date information is crucial for planning and informed decision-making. Availability of such information for air pollution will help policy makers to deal in the best way with issues related to air pollution. So far there has not been any project implemented on the on Mitigation and Control issue. APINA is in the process of carrying a Task on mitigation and control in order to come up best practices in various industries in reducing air pollution.

(ii) a summary of substantive progress;

See above.

(iii) any interaction with the region in terms of help 'in kind' and financial assistance;

Financial assistance is being sought.

(iv) progress on capacity building and ownership detailing prospects for sustainability of built capacity;

See above.

(v) major problems/ set backs;

The only set back has been the non submission of data/information from the APINA country representatives so that scoping studies could be prepared.

(vi) recommendations for improvements

Since it has been difficult to obtain information from the country representatives, I think the best way, is to bring together task team members from all the participating countries to an intensive workshop. Each country should brin the needed information and the country reports should be collated into one

report during the workshop.**3.1.5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally**

APINA is collaborating with many organizations and networks on issues of air pollution in Africa and elsewhere.

3.1.6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

Completion of the scoping reports and planning for the next APINA policy dialogue.

LFA 4.1: Raise awareness for action through targeted dissemination

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: 4.1Raise awareness for action through targeted dissemination	**Project Number:** 731415
Lead institutions: Institute of Environmental Studies and University of Zambia	**Prepared by:** RAPIDC Co-ordinators for APINA, Stephen Simukanga and Sara Feresu

Collaborating Institutions: (name; principal contact; contact details)

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4.1.1 Outline of original project

This activity was intended to raise awareness for action through targeted dissemination by developing APINA publications and outreach.

An Information Officer would be employed to work with the APINA co-ordinator at UNZA. In Phase II the Information Officer was a student but for Phase III it was realised that to develop capacity at UNZA it is necessary to engage an APINA member from the UNZA staff to be given the responsibility for information collation and dissemination. This person, with an interest in air pollution issues, would be recruited to:

- Provide information for the upkeep of the regional APINA website (IES would need a budget to design website and for time to upload new information);
- Produce newsletters;
- Produce APINA series of publications and meetings/seminars;
- Collate and disseminate information supplied by the APINA Country Representatives and Task Team Leaders;
- Upkeep the APINA mailing list and distribute factsheets in collaboration with IES;
- Keep track with the development of air pollution issues in Africa and internationally;
- Develop content of the regional APINA website and publications in collaboration with IES.

Coordinate the APINA activities and enhance the network development. The coordination team was to coordinate all APINA activities and in doing so create synergies and rationalising of resources among the activities.

4.1.2. Describe any deviation from original plan(s) and budget *(with reference to current financial statement)*

The APINA website was supposed to be designed by 30 April 2006. However it has taken time to have it designed. Initial designs have been discussed by the APINA coordination team and are being modified. The website will be ready for launching by the end of May 2007. Four newsletters were supposed to be produced and posted on the website. Three of these have been produced and are ready for posting on the website. A computer has been bought to enhance information flow at the secretariat.

4.1.3. Results, outcomes and deliverables

Refer to publications, book contributions, graphs, tables and raw data (using annexes where appropriate).

- Twelve Proceedings of workshops (Planning meeting in Tanzania; Start up Workshop; First and Second Emissions Training Workshop; First and Second Health Workshops; Biomonitoring Workshop; APINA Annual Meeting; Modelling Workshop; First and Second Corrosion Workshop and Decision Support Workshop) have been produced and are being edited ready for populating the website.
- Six of the National Stakeholders Meetings Proceedings are ready and will also be hosted by the website.
- Four Scoping reports are being reviewed in preparation for posting on the website.
- Three newsletters will also be posted on the website.
- A CD was produced by UNEP on the BAQ-SSA 2006 and circulated to participants and to NFPs for onward transmission to their Permanent Secretaries. A link will be created on the APINA website for accessing the proceedings hosted on the UNEP website.

4.1.4. Assessment and analysis of progress:

What are the capacity enhancement and assessment needs – institutions, activities and personnel and the importance of data quality etc?

There is need to enhance management of the website in the secretariat. There is also need to have a part-time person managing the website. There has been a delay in production of some of the outputs as there is need to quality control the products that are hosted on the website.

B. Specific information relating to your RAPIDC activity:

How is the regional approach advancing the issue in the region? – what capacity is being built up and how does this relate to existing capacity?

Capacity is being built in production of Proceedings of Workshops, collating of information and in designing and managing a website in the region.

C. In addition, could you add:

Any interaction with the region in terms of help 'in kind' and financial assistance;

Institutions such as UNZA and University for Zimbabwe are contributing in kind in terms of space, personnel time, facilities such as computers etc as the project only pays a fraction of the costs required to carry out this task. The website will be hosted free of charge by the University of Zimbabwe.

4.1.5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

-

4.1.6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

All reports will be edited and posted on the website. The RUA proceedings and Fourth Newsletter will also be produced.

LFA 5.1: Develop a Regional Policy Process for Air Pollution in (Southern) Africa

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) November/2005 – April/2006
Project Title: 5.1 Develop a Regional Policy Process for Air Pollution in (Southern) Africa	**Project Number:** 731515
Lead institutions: Institute of Environmental Studies and University of Zambia	**Prepared by:** RAPIDC Co-ordinators for APINA, Stephen Simukanga and Sara Feresu
Collaborating Institutions: (name; principal contact; contact details) **Institution:** Institute of Environmental Studies (IES) **Principal Contact:** Prof. Sara Feresu (Director - IES) **Contact Details:** University of Zimbabwe, P.O. Box MP 167, Mount Pleasant, Harare, Zimbabwe **Phone:** +263-4-302603/332039, Fax: +263-4-332853 **E-mail:** feresu@ies.uz.ac.zw **Institution:** University of Zambia **Principal Contact:** Prof. Stephen Simukanga (APINA Coordinator) **Contact Details:** School of Mines, University of Zambia, P.O. Box 32379, Lusaka, Zambia **Fax/Phone:** +260-1-290281/294086 **E-mail:** simukanga2000@yahoo.com OR ssimukanga@mines.unza.zm **Institution:** Stockholm Environment Institute at York **Principal Contact:** Dr. Kevin Hicks, Mrs Katarina Axelsson	

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5.1.1 Outline of original project

APINA would develop a Regional Policy Process for Air Pollution in (Southern) Africa by:

- Liaising with SADC –Environment Sector in the Directorate of Strategic Planning, Gender and Policy Harmonisation (DSPGPH)
- Liaising with the African Union and UNEP to explore ways of collaboration in air pollution issues
- Developing a third multi-stakeholder policy dialogue

Liaising with SADC –Environment Sector in the Directorate of Strategic Planning, Gender and Policy Harmonisation (DSPGPH).

This activity would allow participation of APINA in the development of the SADC Protocol on Environment Article on Transboundary Air Pollution and in African air pollution issues. The major tasks in this project relate to liasing with SADC–Environment Sector in the Directorate of Strategic Planning, Gender and Policy Harmonisation (DSPGPH) to agree on the process to have the ministers of environment adopt the Declarations that evolve from the APINA Policy Dialogues and aid the development of a Protocol on Environment

The APINA coordinator needs to maintain close contact with SADC- Environment Sector in the DSPGPH over the development of the Article on Transboundary Air Pollution and consensus building among SADC member states. The coordinator would visit SADC- Environment Sector in the DSPGPH and the APINA representative from Botswana would also facilitate contact with SADC-DSPGPH.

Liaising with the African Union and UNEP to explore ways of collaboration in air pollution issues

APINA needs to liaise with the African Union (AU) to seek ways of taking on board the New Partnership for African Development (NEPAD) aspirations on air pollution issues in Africa in the execution of the various activities. APINA will seek ways of linking with the African Ministers Conference on Environment (AMCEN) to promote policies on air pollution mitigation in Africa.

APINA also needs to liaise with UNEP to explore ways of collaboration on air pollution policy issues in Africa. Visits would be made to the AU secretariat and UNEP to initiate discussions on ways of collaboration.

Development of a third multi-stakeholder policy dialogue

A multi-stakeholder policy dialogue is planned to take place during the third year of Phase III (2007/2008) in order to give time for generation of information to present to policy makers. This policy dialogue would be unique in the sense that it would take place after APINA has engaged policy makers in ministries of environment in individual countries who are taking the role of national conveners for APINA activities as National Focal Points (NFPs). This policy dialogue would be an

opportunity to gain further ministerial support for a framework within which agreements and activities on air pollution in SADC countries could be developed. The goal would be that the process being developed by APINA together with SADC-DSPGPH would gain recognition and support from the ministries in each country. This policy dialogue would be supported by information on air pollution issues generated from the various tasks that APINA will undertake during Phase III.

The activities for this task would be preparation of the dialogue, printing of the background documents and factsheets, administration of the meeting, travel to the dialogue and reporting after the meeting.

5.1.2. Describe any deviation from original plan(s) and budget *(with reference to current financial statement)*

The visit to SADC has been delayed since SADC has only employed personnel to take care of Environmental issues at the beginning of 2007. A visit to SADC will be conducted in June 2007.

5.1.3. Results, outcomes and deliverables

Refer to publications, book contributions, graphs, tables and raw data (using annexes where appropriate).

1. Contact has been made with Mr Nyambe at SADC who has informed APINA that SADC is reviving the process of having a SADC Protocol on Environment and that APINA would be a technical partner on crafting the section on air pollution issues. APINA has had a Memorandum of Understanding with SADC to provide an input on air pollution issues since 2001. As stated in 5.1.2 a visit will be made by Sara Feresu and Stephen Simukanga to SADC in June 2007. This will be an opportunity to further discuss:

    - APINA's involvement in the SADC Protocol on Environment process;
    - The upcoming APINA policy dialogue and how we can further the Maputo Declaration including the possibility of SADC co-hosting the Dialogue
    - Possible hosting by APINA and SADC of the BAQ- SSA 2006 follow up activities e.g. the proposed regional meeting on sulphur reduction in fuels

2. Sara Feresu has visited UNEP on many occasions while participating in the GEO4 activity of UNEP. There is a fruitful collaboration between APINA and UNEP as evidenced by APINA being given USD50,000 to make all the logistical arrangements for participants funded by UNEP during BAQ-SSA2006. The possibility of APINA hosting the sub-regional follow up meeting on sulphur reduction in fuels as a follow up to BAQ 2006 is being discussed with UNEP and the World Bank. As already mentioned Sara Feresu has now participated in authoring chapters in the UNEP Geo Outlook Year Book 2006 and the GEO 4 soon to be published; all this as an off shoot of APINA activities.

3. APINA will also be a collaborating partner for the African region on the GAP Forum activity.

4. With regards to NEPAD and AMCEN, APINA invited Dr Mugabe of NEPAD as guest of honour to its start-up workshop. Emanating from this Dr Mugabe is now a member of PAG. This should strengthen APINA 's ties with NEPAD.

5. The chairperson of AMCEN attended the BAQ-SSA 2006 and was involved in the opening and closing sessions of the Ministerial session.

6. APINA held a side event at BAQ SSA 2006 for senior officials of SADC ministries of Environment that was reported in the previous report.

7. APINA has held a Decision Support Workshop that was attended by TTLs of all activities and the NFPS in order to be trained and discuss how to format information for the policy makers in preparation for the policy dialogue. As a result terms of reference will be drawn for National Stakeholders meetings so that they can better feed into the Policy Dialogue process.

5.1.4. Assessment and analysis of progress:

A. General information and context concerning the issue being addressed by the RAPIDC activity:

B. Specific information relating to your RAPIDC activity:

(i) How is the regional approach advancing the issue in the region? – what capacity is being built up and how does this relate to existing capacity?

Capacity has been built within APINA and the RAPIDC programme is starting to bear fruits in the region. APINA is now being recognised by other players and regional bodies in the Africa as a partner in influencing policy on air pollution issues in the region. APINA activities should be in a position to provide some scientific information on the status of air pollution and its impacts in the region for better informed national and regional policy making. The involvement of NFPs in APINA has helped create awareness and interest on air pollution issues in governments of the region. Hopefully this should lead to agreement(s) on how to tackle air pollution in the region at the next policy dialogue.

C. In addition, could you add:

-

5.1.5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

-

5.1.6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

APINA will hold its second and last APINA annual meeting for Phase III in October/November 2007 at the Victoria Falls in Zimbabwe in preparation of the Policy Dialogue. Task teams will start finalizing their activities and packaging the information gathered during Phase III of the programme. Preparation of the policy Dialogue: Sara Feresu and Stephen Simukanga will visit SADC and will also participate in BAQ-SSA 2006 follow up activities and the GAP Forum activities.

LFA 5.2: Promote Better Air Quality Management in the cities of Africa

RAPIDC Annual Report	Period covered by report: (month/year to month/year) November/2005 – April/2006
Project Title: Promote Better Air Quality Management in the cities of Africa	LFA numbers (Project Numbers): 5.2
Lead institutions: Institute of Environmental Studies and University of Zambia	Prepared by: RAPIDC Co-ordinators for APINA, Stephen Simukanga and Sara Feresu

Collaborating Institutions: (name; principal contact; contact details)

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Institution: University of Zambia
Principal Contact: Prof. Stephen Simukanga (APINA Coordinator)
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5.2 Outline of original project

APINA Activity 5.2 Promote Better Air Quality Management in the cities of Africa

An important development towards the end of APINA phase II was the holding of a workshop in April 2004 in Johannesburg, South Africa, entitled 'Better Air Quality – Africa, 2004' with the theme 'Air Quality in Cities of Africa'. The workshop investigated the possibility of a consortium approach to air quality management in the major cities of Africa. African and other experts from the international community were invited to give presentations. This initiative was led by APINA through the RAPIDC Programme in partnership with UNEP, WHO, the African Development Bank and SEI.

It has always been an aspiration of APINA to start activities in Africa as a whole and this was the first pan African APINA meeting. It is also a sister network to the RAPIDC's Asian air quality management activity on Air Pollution in the Megacities of Asia (APMA) and it aims at emulating this initiative by establishing an annual Better Air Quality (BAQ) meeting for Africa in collaboration with the WHO, AfDB and UNEP.

Phase III of APINA would see the development of a Better Air Quality (BAQ) in Cities of Africa initiative with the overall objective of promoting synergies and complementarities between the various initiatives on air quality management in Africa. Specific objectives include:

- Identifying and approaching lead facilitators such as UNEP (partnership for clean fuel and vehicles) and World Bank (Clean Air Initiative – sub-Saharan Africa) to facilitate synergies;
- Linking with existing and planned training workshops and meetings;
- Undertaking benchmarking on air Quality in cities of Africa and facilitating information exchange;
- Promoting strategic approach to AQM.

Activities to be undertaken by APINA during the implementation of BAQ Africa include:

- Promoting the BAQ Africa to principle facilitators;
- Organising APINA's Air Quality Management (AQM) workshops back to back with BAQ – Africa;
- Organising training workshops on AQM;
- Benchmarking air quality management in some cities of Africa in year 1 if funding allows;
- Promoting regional dialogue on AQM.

The Tanzania planning meeting, which was attended by representatives from the UNEP Regional Office in Nairobi and the WHO Regional Office in Congo-Brazaville, identified three aspects that need to be included in the Phase III APINA proposal. These were:

- WHO to contribute to side events on training on various issues such as Rapid Environmental Health Assessment and health costs in conjunction with other partners;
- Regional AQM Coordinating meeting facilitated by one of the lead agencies;
- Hold next BAQ Africa 2005 meeting in Nairobi, request UNEP to host.

Coordinate the APINA activities and enhance the network development. The coordination team was to coordinate all APINA activities and in doing so create synergies and rationalising of resources among the activities.

5.2.2. Describe any deviation from original plan(s) and budget *(with reference to current financial statement)*

None

5.2.3. Results, outcomes and deliverables

Refer to publications, book contributions, graphs, tables and raw data (using annexes where appropriate).

APINA has achieved more than what it anticipated during the planning of Phase III. Starting with modest participation by 12 African countries in BAQ 2004 in Phase II, with the help of UNEP, World Bank and SEI, APINA has managed to co -organize BAQ-SSA 2006 with participation from 49 sub- Saharan Africa countries. The activity was reported in the last six monthly report but indeed shows that APINA has met the set objectives of this activity.

BAQ-SSA 2006 included a training session on air Quality Management which was attended by stakeholders that are involved in air Quality Inventory assessment and Monitoring. Over 60 participants from the 49 Sub-Saharan countries attended the training session.

Discussions are underway to host a sub regional meeting on sulphur reduction in fuels as a follow up activity of BAQ-SSA 2006. The proceedings of the workshop can be accessed on the UNEP web site.

From discussions during the recent visit to UNEP, APINA is now being included in project proposals for fund raising by the World Bank and UNEP for follow up activities of BAQ-SSA 2006.

5.2.4. Assessment and analysis of progress:

A. General information and context concerning the issue being addressed by the RAPIDC activity:

-

B. Specific information relating to your RAPIDC activity:

-

C. In addition, could you add:

-

5.2.5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

-

5.2.6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

APINA is planning to produce a strategic framework for Maputo City as a complementary exercise to RUA using contingency funds.

APINA will continue to participate in follow up meetings to the BAQ-SSA 2006 including the possible hosting of a regional meeting on sulphur reduction in fuels in February 2008.

LFA 6.1: Enhancing networking and co-ordination

RAPIDC Annual Report	Period covered by report: (month/year to month/year) May 2006 – April 2007
Project Title: Enhancing networking and co-ordination	**LFA numbers (Project Numbers):** 6.1
Lead institutions: Institute of Environmental Studies and University of Zambia	**Prepared by:** RAPIDC Co-ordinators for APINA, Stephen Simukanga and Sara Feresu

Collaborating Institutions: (name; principal contact; contact details)

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Institution: University of Zambia
Principal Contact: Prof. Stephen Simukanga (APINA Coordinator)
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Institution: Stockholm Environmental Institute at York
Principal Contact: Dr. Kevin Hicks, Mrs Katarina Axelsson
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E-mail: khicks@york.ac.uk (Kevin) katarina.axelsson@sei.se (Katarina)

6.1.1 Outline of original project

This activity was meant to enhance networking for regional co-operation on air pollution issues through:

- Attendance of relevant meetings by APINA members;
- APINA Annual Network Meetings; and
- APINA co-ordination

Attendance of relevant meetings by APINA members

One of the successes of APINA in Phase II was the allocation of resources allowing APINA members to respond to requests to attend relevant meetings organised by other networks and initiatives. This provided the opportunity to disseminate information about APINA and forge partnerships with initiatives that recognised APINA as a means transferring scientific information to the policy arena in southern Africa. During phase II, two such partnerships were developed with SAFNet (the Southern African fires Network) and Southern African Regional Science Initiative (SAFARI 2000). Furthermore, these funds allowed APINA representatives to attend joint meetings with Malé

LFA 6.1: Enhancing networking and co-ordination

RAPIDC Annual Report	Period covered by report: (month/year to month/year) May 2006 – April 2007
Project Title: Enhancing networking and co-ordination	LFA numbers (Project Numbers): 6.1
Lead institutions: Institute of Environmental Studies and University of Zambia	Prepared by: RAPIDC Co-ordinators for APINA, Stephen Simukanga and Sara Feresu

Collaborating Institutions: (name; principal contact; contact details)

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6.1.1 Outline of original project

This activity was meant to enhance networking for regional co-operation on air pollution issues through:

- Attendance of relevant meetings by APINA members;
- APINA Annual Network Meetings; and
- APINA co-ordination

Attendance of relevant meetings by APINA members

One of the successes of APINA in Phase II was the allocation of resources allowing APINA members to respond to requests to attend relevant meetings organised by other networks and initiatives. This provided the opportunity to disseminate information about APINA and forge partnerships with initiatives that recognised APINA as a means transferring scientific information to the policy arena in southern Africa. During phase II, two such partnerships were developed with SAFNet (the Southern African fires Network) and Southern African Regional Science Initiative (SAFARI 2000). Furthermore, these funds allowed APINA representatives to attend joint meetings with Malé

Declaration initiatives and foster south-south linkages within RAPIDC. Funds have, therefore, been included here to continue such activities.

APINA Annual Network Meetings

APINA network meetings serve the purpose of reviewing the progress of APINA activities and providing a forum for strategic planning and facilitating regional ownership of APINA activities. In Phase III these meetings would be timed to run in parallel with training workshops and other meetings in an effort to rationalise resources. Funds are being requested to continue with these annual APINA network meetings in Phase III.

APINA co-ordination

To ensure the smooth running and success of APINA and enable it to link successfully with the rest of the RAPIDC programme the APINA Co-ordinator (Stephen Simukanga at UNZA) and Secretariat (Sara Feresu at IES) require funds to attend relevant meetings with Sida, the Programme Steering Committee (PSC) and the new Programme Management Committee (PMC). It would be the PMC that oversees to development of the 'bridging phase' whereby regional ownership would be enhanced and APINA take on more responsibility for the content and reporting of APINA activities.

Funds have also been allocated to enable UNZA and IES to build the capacity to support the increased co-ordination responsibilities. This includes the funding of new APINA personnel at UNZA and IES. At UNZA the TOR for the Information Officer would include assisting the Co-ordinator in the day to day running of the APINA network and at IES additional support personnel for Sara Feresu has been allocated.

6.1.2. Describe any deviation from original plan(s) and budget *(with reference to current financial statement)*

Coordination has been going on well. There have been no deviations from the original budget for this activity.

6.1.3. Results, outcomes and deliverables

Refer to publications, book contributions, graphs, tables and raw data (using annexes where appropriate)

In relation to attendance of relevant meetings by APINA members:

- Four members of the APINA Bio-monitoring team attended the APCEN meeting in Stellenborsch, South Africa in September 2006.
- The APINA TTLs attended the Debits meeting in Kruger National Park, South Africa in September 2006.
- The APINA Coordinator attended an air quality management meeting in Durban in May 2006.
- APINA has funded Chozi Lungu to attend the Tenth International Conference on Atmospheric Sciences and Applications to Air Quality in Hong Kong and present a paper on "Establishing corrosion impacts of air pollution in southern Africa"

The following are the outcomes and deliverables from the APINA Coordinating Team:

- Facilitating the organising the first National Stakeholder meetings in all the seven APINA participating countries;
- Convening the APINA special session at IGAC;
- Helping with the organisation of APCEN meeting in Stellenborsch;
- Facilitating the organising of the second training workshops for the Emissions and Health Task Teams held in Cape Town, South Africa in September 2006.
- Organised the APINA annual meeting held in Cape Town, South Africa in September 2006.
- Continued networking with NFPs, ACRs, TTLs and TTMs to enhance development of the network.
- Managing seventy two (72) sub-contracts within APINA.
- The coordination team participated in organising the Better Air Quality in Sub-Saharan Africa (BAQ SSA) held in July 2006 in Nairobi, and in addition to managing the Sida funds, managed US$50,000 on behalf of UNEP.
- The Coordination Team organised an APINA side event at the BAQ-SSA 2006 conference.
- The Coordination Team has facilitated organising of various workshops in the network such as the Corrosion one (February 2007), Modelling (February 2007) and Decision Support (April 2007).
- Organised an APINA side event at the IGAC Conference in September 2006 in Cape Town at which 4 APINA papers and posters were presented.
- The Coordination team has participated in the PMC teleconferences
- The coordination team has participated in producing RAPIDC reports.

6.1.4. Assessment and analysis of progress:

A. General information and context concerning the issue being addressed by the RAPIDC activity:

-

B. Specific information relating to your RAPIDC activity:

-

C. In addition, could you add:

-

Development of Coordination assistance has been slow. Dr. Osbert Sikazwe, who has been assisting the Coordinator at UNZA went to the USA on sabbatical leave and is due to come in May 2007. This has made coordination of issues a bit delayed in some cases because of delayed response to them. At IES, there has been change of personnel in the secretarial and finance section. The new people had to adapt to APINA activities and reporting. This has contributed to any delays in reporting that might have been experienced. However, these issues have been overcome as the personnel are now well versed with APINA activities and are responding well to issues.

(vi) recommendations for improvements

As the programme expands and grows it is recommended to have a full time paid assistant located at IES to assist the coordination team and follow up APINA activities on a day-to-day basis in Phase IV. This will facilitate quick response to issues.

6.1.5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

e.g. north –south and south –south linkages etc

The APINA Coordination Team is working with UNEP-Partnership for Clean Fuels and Vehicles and the World Bank Clean Air Initiative in Sub-Saharan African Cities on better Air Quality issues and follow up as well as other partners that contributed to the BAQ SSA conference in Nairobi. The Coordination Team has links with the technical advisors for emissions inventory, crops, health, corrosion, decision support and RUA activities. There are also strong linkages with the RAPIDC coordinating team at SEI.

APINA is also participating in GAP Forum activities

6.1.6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

- Facilitating the upcoming second national stakeholder meetings in May to July 2007 will form part of the activities in the next 6 months.
- The Coordinating Team will visit the SADC secretariat in Botswana to re-establish links and discuss future collaboration.
- Participate in the Global Atmospheric Pollution Forum being activities. Discussions are underway on how activities will be executed in Africa in collaboration with UNEP.
- Produce an half yearly report by October 2007.
- Attend PMC and Technical Advisory Committee (TAC) meetings in May 2007 in Stockholm.
- Organise the RUA Training Workshop to be held in June/July 2007 in collaboration with TTL.
- Organize the APINA annual meeting in November 2007.
- This year is a crucial year for the coordinating team as it has to begin preparations for the Regional Policy Dialogue to take place in 2008.
- Coordinate the writing up of Phase IV proposal

6.1.7. Gender, poverty and HIV/Aids issues relevant to project

More than half of the coordination team are female especially at IES. The finances and day to day management of the programme are carried out by females. The Director of IES who is part of the coordinating team is also female. In terms of gender, the Coordinating team is well balanced.

Appendix 5 Report from RAPIDC Network activities

A5.1 Air Pollution and Crop Effects Network

APCEN Result 1. Activities of crop-air pollution scientists effectively co-ordinated

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: APCEN Activities 1, 2 & 3	**Project Number:** 732105 (Malé) and 733005 (APINA)
Lead institution: SEI	**Prepared by:** SEI
Collaborating Institutions: (name; principal contact; contact details) **Institution:** SEI **Principal Contact:** Dr. Lisa Emberson **Contact Details:** University of York, Heslington, York, U.K., YO10 5DD **Phone:** +44 1904 432925 **E-mail:** l.emberson@york.ac.uk **Other collaborators**: Banaras Hindu University (BHU), Varanasi, India (Prof. Madhoolika Agrawal); University of the North West, Potchefstroom, South Africa (Prof. Gert Krüger); CSIR Environmentek, Durban, South Africa (Mieke v. Tienhoven); Gothenburg University, Gothenburg, Sweden (Prof. Håkan Pleijel); University of Sussex, Sussex, UK (Dr. Fiona Marshall); Centre for Ecology and Hydrology (CEH), Bangor, UK (Dr. Harry Harmens).	

Assessment and analysis of progress:

1. Outline of original project

There are three main aims for the APCEN network during this phase: i) to consolidate, maintain and expand the existing network; ii) to capacity build experimental expertise in the regions; and iii) to engage policy makers in the evidence based science collated in the regions.

In this current phase of the RAPIDC programme the APCEN network is developing the experimental protocols for use in the Malé and APINA experimental activities and also APCEN is responsible for undertaking the Malé and APINA pilot studies to prove that the experiments are suitable in the two regions. The network also provides guidance on how the results of these activities should best be presented to appropriate policy makers.

2. Describe any deviation from original plan(s) and budget

The project is on schedule with the exception of the performance of the clover-clone pilot study in India since we have still been unable to obtain a plant import permit for the clover cuttings. In May 2006 we asked for help with this issue from Male via UNEP and the Indian NIA. Unfortunately, little progress has been made in this regard despite the frequent reminders sent from SEI to both UNEP and the Indian NIA detailing the urgent need for this permit. We are still hoping that the permit will be available in time to catch some of this years growing season in India (which started November 2006). However, as this may be unlikely we are concentrating efforts to ensure the clover-clone study is performed in Lahore, Pakistan where clover clones have now been established as of February 2007.

Since the EDU manufacture costs more than was originally budgeted for we have now identified a means of having the EDU produced in Potchefstroom, South Africa at a reduced cost. The team in

South Africa have agreed to supply south Asia with EDU whilst we identify a suitable means of manufacture in the Asian region.

3. Results, outcomes and deliverables

In order to assess the suitability of the proposed experiments (bio-monitoring and chemical protectant study) and the experimental protocols developed under APCEN, a bio-monitoring pilot study was carried out in South Africa in the 2005/06 growing season using two genotypes of white clover with different sensitivity to ozone. The same experiment is also planned for India but has been delayed due to problems with obtaining the plant import permit. The chemical protectant study (using EDU) has been performed in Varanasi, India during the growing season 2005/06 and is currently also under way in South Africa.

The second APCEN network meeting (first of this funding phase) was held in Stellenbosch, South Africa in Sept. 2007 with 21 attendees from 11 different countries. This meeting finalised the protocols for the clover and EDU experiments for use in southern Africa (APINA) and South Asia (Malé) and considered what further work needs to be done to enable socio-economic based risk assessments for the regions (there is a workshop report available with further information).

The entire APCEN network now comprises 74 members from 25 countries and a steering committee will be established during the summer 2007.

A number of publications focussing on collating evidence of air pollution impacts to crops in both South Asia and southern Africa and on identifying knowledge gaps and future research needs have been prepared by APCEN network members active within the RAPIDC programme (Emberson et al. 2000; Emberson et al. 2003; Emberson et al. (in press))

Over the past few months we have also been concentrating on establishing region specific dose-response relationships for key crops (cereals (wheat and rice), legumes (different bean varieties) and vegetables. We have been helped in this regard by establishing this as an MSc project undertaken by Environmental Science students in the Environment Department at York University. APCEN members have provided these students with data (papers, reviews, datasets), which have been synthesised by the students. These relationships can then be compared with existing European and North American relationships to infer any variability between regions in sensitivity of crops and varieties and also to identify knowledge gaps to target future research more effectively towards developing such dose-response relationships which are crucial for the establishment of local/regional air quality guidelines and to inform appropriate air quality management.

Raising awareness of the issue is a key challenge over the next few years for the APCEN network. To date we have started to address this through the publication of books, papers, establishment of the website and presentation of the project at scientific meetings (IGAC, Cape Town, South Africa, 2006; BAQ, Yogjakarta, Indonesia, 2006; ABC, Bangkok, Thailand, 2006; UNECE CLRATP ICP Vegetation, Dubna, Russia, 2007), all geared towards establishing a firm science based foundation and peer review of evidence of impacts. We feel this has raised the awareness of the issue within the scientific community. This awareness raising has been aided by complementary global modelling based research which has focussed on assessing future projections of surface ozone (e.g. Prather et al, 2001; Dentener et al., 2006). These studies have raised the profile of surface ozone with respect to climate change (since O_3 is the third most important greenhouse gas) as well as raising concerns over direct impacts to human health and vegetation. Members of the APCEN network are in consultation with these researchers to help identify suitable methods that can be used to assess risk of vegetation to surface O_3, particularly in developing country regions, the need for risk assessments in Asia is an

obvious area of research that requires immediate attention given the high projected increases in surface O_3 (and the knowledge of impacts under current day conditions) and is an area of research where APCEN is in an excellent position to provide advice and recommendations on the performance of evidence based risk assessments for this global modelling community. The heightened awareness of the issue of increasing surface ozone and potential impacts to crops was exemplified by a recent call for evidence by the Royal Society on "Ground-level ozone in the 21st Century" (http://www.royalsoc.ac.uk/page.asp?id=2556) to which ACPEN submitted evidence based on the past, and ongoing research conducted under the auspices of the RAPIDC programme.

References for the previous section (those in bold are publications arising from the RAPIDC crops project)

Dentener, F., et al. (2006). The global atmospheric environment for the next generation. Environmental Science & Technology 40, 3586-3594.

Emberson, L.D., Ashmore, M., Murray, F. (2003): Air pollution impacts on crops and forests. A global assessment. Imperical College Press, London.

Emberson, L.D., Büker, P., Engardt, M., van Tienhoven, A.M, Agrawal, M., Zunckel, M., Hicks, K., Pleijel, H. Assessing air pollution impacts to agriculture: A framework methodology for assessing the risks caused by ground-level ozone (O_3) in South Asia and southern Africa. In: Pal, A. (Ed.), ASEAN - Environmental Perspectives, in press.

Emberson, L.D., Ashmore, M.R., Murray, F., Kuylenstierna, J.C.I., Percy, K.E., Izuta, T., Zheng, Y., Shimizu, H., Sheu, B.H., Liu, C.P., Agrawal, M., Wahid, A., Abdel-Latif, N.M., van Tienhoven, M., de Bauer, L.I., Domingos, M., 2001. Impacts of air pollutants on vegetation in developing countries. Water, Air and Soil Pollution 130, 107-118.

Mauzerall, D., and Wang, X. (2001). Protecting agricultural crops from the effects of tropospheric ozone exposure. Annul Rev. Energy & Env. 26: 237-68

Prather M., et al., (2003) Fresh air in the 21st century? Geophysical Research Letters 30 (2): 1100

4. Assessment and analysis of progress:

Over recent years APCEN has been involved in activities to try to collate and synthesise information describing current day impacts of air pollution in developing country regions. These studies have been synthesised in a number of publications (Mauzerall & Wang, 2001; Emberson et al. 2000; Emberson et al. 2003; Emberson et al. (in press)). They indicate that SO_2 and O_3 are a known concern in south Asia, and of questionable concern in southern Africa where less evidence of the geographical extent and magnitude of the problem exist. This reflects the awareness of the issue in the different regions.

In Asia, research investigating the Atmospheric Brown Cloud (ABC) has heightened interest into the effects of the pollutant mixture on agriculture, in fact APCEN members have been asked to advise on methods to assess agricultural impacts from key pollutants such as ozone and SPM at ABC workshops though no formal links between the two projects have yet been established. Such links could be beneficial by pooling resources and extending the area over which the standardised protocols used within RAPIDC are applied.

The establishment of the APCEN network (which has developed and maintained a skills and expertise database as the network as grown) has identified the existing capacity for crop effect air pollution research across the globe with a focus on the southern African and south Asian region. In the latter the

expertise and facilities exist but as yet, there potential has not been fully realised, the establishment of the bio-monitoring networks marks one significant step to achieving this goal. In the former, the expertise and facilities are extremely limited (only really being present in one country of the region) but the capacity building initiatives undertaken with the RAPIDC programme have quickly raised interest in the issues and capacity to start to make assessments of damage. Ideally, this interest and capacity would be consolidated in future funding phases.

There is an urgent need to turn attention more to engaging with policy stakeholders (through both the inter-governmental (via the Maputo dialogue and the Malé declaration) as well as the national and local governmental level). However, we also perceive that there is an urgent need to raise awareness amongst those stakeholders that may be most affected by crop damage (e.g. subsistence and commercial farmers, food sellers and consumers). To this end we propose to target the development of the socio-economic framework towards specific assessments of impacts for these various stakeholders and providing policy relevant information for a emission sectors and adaptation options. This can only be realistically achieved having established the evidence-based science to substantiate a call for policy intervention that has been the focus of the RAPIDC crops project to date. Further work is needed to consolidate this knowledge base, the development of standardised protocols for application across the region marks a significant step forward but we are still some way off finding the resources that would be needed to actually apply these protocols in a co-ordinated fashion across the region, ideally an experimental campaign similar to the NCLAN (National Crop Loss Assessment Network) and EOTC (European Open Top Chamber Study) would be established. This would provide the level of scientific knowledge to make more accurate regional scale risk assessments from which to develop more targeted policy interventions.

All of these factors that require a regional approach are facilitated by the network whose current focus is the development, application and interpretation of standardised protocols for impact assessment.

The APCEN network now comprises more than 60 pollution effect practitioners from around the globe but largely from Asia with recently expanding numbers in southern Africa.

The APCEN network has now met at two workshops, the first held in Bangkok, Thailand in 2003; the second in Cape Town, South Africa 2006. A third workshop is planned for India for early 2008. The focus of these workshops has moved from collating, synthesising and assessing evidence of air pollution impacts to crops; to the development of protocols (both observational and experimental) to fill the knowledge gaps identified from the initial work.

The experimental protocols that have been developed and piloted have resulted in the establishment of two standardised methods (a clover clone bio-monitoring method and a chemical protect study).

We are currently developing a socio-economic framework that will be used in conjunction with our evidence-based knowledge of air pollution crop impacts to identify appropriate policy interventions that would ideally complement all RAPIDC activities.

We are close to having a finalised version of the ACPEN website which will act as a portal allowing interested practitioners access to expert advice and information, APCEN member details, relevant research papers and books and links to other relevant websites.

Paragraph on your project that you might put in a press release:

Surface ozone is a pollutant of growing concern globally. Currently, all estimates of ozone impacts to agriculture are based on European or North American air quality guidelines based on species and cultivars local to those regions. However, one of the regions most at threat from compromised food availability due to increased levels of this pollutant is south Asia. The APCEN network is involved in establishing and capacity building methods that can assess impacts to species and cultivars local to this region in particular. This will enable the development of more accurate risk assessments including socio-economic impact studies that will provide a sounder basis upon which to develop appropriate policy interventions to deal with the issue.

Capacity building, ownership and sustainability: The APCEN network has successfully built capacity in the regions in the application of these protocols, this will allow assessments both within and between regions of air pollution impacts to crops. Application of these methods within the regions will provide information for the provisional risk assessment modelling that has been performed within the regions (see Malé and APINA reports). Devolution to the regions is also ongoing, the Potchefstroom site in southern Africa is now able to propagate its own stock clover-clone plants and manufacture EDU (see APINA report). Establishment of a similar system in Asia is underway.

major problems/ set backs; Problems in obtaining a plant-import permit for India for the clover-clone pilot study.

Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally e.g. north –south and south –south linkages etc

The project has links with the following bodies:-

- ICP Vegetation and UNECE CLRTAP (bio-monitoring)
- RAPIDC Malé and APINA (bio-monitoring)
- ABC (attendance of APCEN members at "Agricultural Impacts" workshops)
- Provision of evidence for the Royal Society "Ground-level ozone in the 21st Century" study
- International Rice Research Institute (IRRI) who are members of the APCEN network
- Links with a new FACE (Free Air Concentration Enrichment) project in China assessing ozone impacts on rice and wheat; an APCEN member is PI of this project and APCEN members sit on the project advisory board.

Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III. The focus will be on consolidation of APCEN outreach materials (e.g. finalisation of the APCEN website), finalisation of the APCEN organisational structure (e.g. steering committee) and preparation for the 3rd APCEN workshop scheduled for early 2008, venue likely to be Delhi, India. This workshop will focus on developing appropriate socio-economic assessment methods.

Gender, poverty and HIV/Aids issues relevant to project. Development of the socio-economic framework will incorporate methods to assess impacts to different sectors of society, focussing on the poor and vulnerable who may be most affected by air quality impacts.

Any other relevant comments/grievances etc Difficulty in obtaining the plant import permit for India with little help forthcoming from the relevant Malé contacts and country NIA.

A5.2 Corrosion Network

CORNET Result 1. Understanding of the impact of air pollution on corrosion of materials under Asian and African conditions

RAPIDC Half-Yearly Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: Corrosion impacts of air pollution in developing countries. Activities linking science and policy in Africa and Asia	**LFA numbers (Project Numbers):** CORNET 1.1 and 1.2 (Asia, 732 205) 1.1 and 1.2 (Africa, 733 105)
Lead institution: Corrosion and Metals Research Institute (KIMAB)	**Prepared by:** Corrosion and Metals Research Institute (KIMAB)
Collaborating Institutions: (name; principal contact; contact details) A list of contact persons relavant for the corrosion network (CORNET) is presented in the Report of the Malé Declaration Training Workshop on Evaluation of Corrosion Attacked on Materials 09 – 11 October 2006.	

Assessment and analysis of progress:

Outline of original project

Overview of activities and sub-activities

CORNET
1.1 Corrosion Network (CORNET) development and capacity building
1.1.1 Hold workshop and training
1.2.1 Collection of relevant data
1.2.2 Trend exposure

Original budget

The contract for the Corrosion and Metals Research Institute (KIMAB) specifies:

1.1 (CORNET):	1 443 530 SEK
Total:	2 335 358 SEK

Deviation from original plan(s) and budget

- There is no deviation from the original plan/budget related to the present contract

- Related to CORNET sub-activity 1.1.1 Hold workshop and training there has been a request of an additional workshop in the beginning of 2008 on evaluation and interpretation of results.

Results, outcomes and deliverables

Achievements are shortly described activity by activity with references to deliverables where appropriate:

CORNET

1.1 Corrosion Network (CORNET) development and capacity building

1.1.1 Hold workshop and training

- a workshop on sample evaluation was held in Bangkok, Thailand, 9-11 October 2006. ***Deliverable***: Report from the workshop prepared by UNEP in co-operation with KIMAB

1.2.1 Collection of relevant data

- the 4-year exposure in the original network of test sites from the previous phase of RAPIDC was completed and a database is almost established for development of dose-response functions

1.2.2 Trend exposure

- evaluation of trend results are on-going and partly completed by partners in Asia, Africa and KIMAB.

Assessment and analysis of progress:

Corrosion is considered as one of the important impacts of air pollution. The current level of understanding on the highest educated level is that acidifying pollutants, mainly SO_2 is a large contributor to the observed corrosion levels. What is not known is to what extent and how the different climatic conditions compared to Europe affects the relative importance of the effects of local and long-distance transported pollutants. On a lower education level and by the population in general corrosion is considered a problem but is not linked to air pollution.

Suggestion for press release;

Air pollution destroys buildings and cultural heritage in developing countries.

Poor people in developing countries not only suffer from health problems but also have to deal with leaking roofs and that their precious national heritage symbols crumble before their eyes. All this is due to air pollution, which has increased dramatically in recent years because of increased transportation and energy use. The problem is addressed in a SIDA financed project on corrosion impacts in developing countries. The project has established a corrosion network (CORNET) with a growing number of participants from Asia and Africa who together provide knowledge to policy makers for reducing pollution in a cost-effective way.

Summary of substantive progress;

The corrosion network (CORNET) has grown from 12 test sites in Asia and 4 test sites in Africa to 16 test sites in Asia and 6 test sites in Africa. All these partners and potential new partners met at the workshop on sample evaluation was held in Bangkok, Thailand, 9-11 October 2006.

Capacity building and recommendations for improvement

The workshop on sample evaluation was specifically designed to build capacity and is now followed up by analyses in individual countries. There is a significant variation in capacity level – not between regions (Asia-Africa) but from country to country. Some countries / partners are still struggling to carry out the basic tasks of exposing specimens while other countries / partners are close to the level of taking over as a sub-centre for evaluation of corrosion attack for a single material or group of materials. More training is needed, on both a very basic level, but also more advanced training for selected partners.

Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

The close link established between collaborating partners in Asia and Africa within CORNET has been considered very useful from the aspect of sharing personal experiences and solutions but also by sharing data. Future proposals and activities from Male and APINA needs to be co-ordinated to ensure that this good co-operation continues in future phases of RAPIDC.

It is also recommended for to establish closer link between activities in Europe / CLRTAP networks and other regions of the world.

Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

CORNET

1.1 Corrosion Network (CORNET) development and capacity building

1.1.1 Hold workshop and training

- workshop on evaluation and interpretation of results beginning 2008 (if funds available)

1.2.1 Collection of relevant data

- evaluation of dose-response functions

1.2.2 Trend exposure

- establishment of trends in corrosion and pollution and comparison of samples evaluated in individual countries to those evaluated in KIMAB.

General

For the next phase of the programme, and in order to achieve a sustainable network, it is necessary to appoint sub-centre(s) in the two regions that can take on a leading role. Male and APINA should be responsible for the appointments, in consultation with KIMAB if found appropriate. Several criteria need to be considered taking into account technical and political considerations.

A5.3 The Composition of Asian Deposition

CAD Result 1. The scientific understanding of deposition, atmospheric transfer and impacts of air pollution in Asia promoted

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: Composition of Asian Deposition (CAD) Network and Enhanced monitoring capacity for the Malé Declaration	**Project Number:** 732005
Lead institution: Department of Meteorology, Stockholm University (MISU), Sweden	**Prepared by:** Henning Rodhe

Collaborating Institutions: (name; principal contact; contact details)

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Assessment and analysis of progress:

Outline of original project

1 CAD Network development: 449,105 SEK

2 Capacity building for air pollution in Asia: 1140,212 SEK

Deviation from original plan(s) and budget

None

Results, outcomes and deliverables

Refer to publications, book contributions, graphs, tables and raw data (using annexes where appropriate).

The most important result of the current reporting period was a successful CAD workshop held in Hyderabad, India 30 Nov – 2 Dec 2006. The workshop, which was attended by 25 scientists from 9 countries, was chaired by the CAD co-ordinator Dr. Bala. Many important results were presented and discussed during the workshop, see the Attached workshop report. A major emphasis was placed on further improvements of the measurement and chemical analysis techniques and the quality assurance

of the data. All CAD laboratories are now participating in an international inter-comparison test organized by the EANET project co-ordinated by Japan.

One of the major conclusions of the discussions was that acidification is not likely to be a serious concern during the next few decades in South, South-East and East Asia – except for some areas in SW China. This is due to the alkaline nature of most Asian soils that tend to neutralize the acids formed from the emissions of sulphur and nitrogen oxides. This conclusion is based both on results from the CAD network and on research carried out in co-operation with scientists at SEI/York.

This result is still tentative and has to be followed up by further investigations, in particular regarding the sensitivity of soils in different regions. The fundamental role of atmospheric aerosols for climate and health motivates an increased focus on aerosols in a possible future phase of the CAD program.

A selection of key publications resulting from the CAD program in recent years:

Review of precipitation monitoring studies in India - a search for regional patterns : Kulshrestha UC, Granat L, Engardt M, Rodhe H , ATMOSPHERIC ENVIRONMENT (2005) 39 (38): 7403-7419 .

Study of chemical composition of rainwater at an urban (Pune) and a rural (Sinhagad) location in India : Momin GA, Ali K, Rao PSP, Safai PD, Chate DM, Praveen PS, Rodhe H, Granat L , JOURNAL OF GEOPHYSICAL RESEARCH-ATMOSPHERES (2005) 110 (D8): Art. No. D08302 .

Study of aerosol transport through precipitation chemistry over Arabian Sea during winter and summer monsoons : Praveen PS, Rao PSP ,Safai PD, Devara PCS, Chate DM, Ali K, Momin GA , ATMOSPHERIC ENVIRONMENT (2007) 41 (4): 825-836 .

Interlaboratory study to improve the quality of trace element determinations in rainwater : Karthikeyan S , Balasubramanian R, ANALYTICA CHIMICA ACTA (2006) 576 (1), 9-16 .

Chemical composition of rainwater and dustfall at Bhubaneswar in the east coast of India : Das R, Das SN, Misra VN , ATMOSPHERIC ENVIRONMENT (2005) 39 (32): 5908-5916.

Country to country transport of anthropogenic sulphur in Southeast Asia:

Engardt M, Siniarovina U, Khairul NI, Leong CP, ATMOSPHERIC ENVIRONMENT (2005) 39 (28): 5137-5148 .

Assessment and analysis of progress:

A. General information and context concerning the issue being addressed by the RAPIDC activity:

(i) What is the status of the issue in the relevant region?

- How important is it politically? *Acidification is probably less important than previously believed. The most important air pollution issues in the region are probably the aerosol/health and aerosol/climate issues and the impact of enhanced surface ozone on crops.*
- Has there been a change in awareness/relevance of the issue in the region(s) in the last ten years? *There has definitely been an increased awareness of the role of aerosols, cf. the ABC project.*
- What is the knowledge about this issue in the region? *The knowledge of the acidification issue has increased considerably. CAD has contributed to this.*
- What is the level of capacity to study this issue in the region? *Getting better.*

(ii) What are the capacity enhancement and assessment needs – institutions, activities and personnel and the importance of data quality etc? *There is a need to identify a lead institute in South Asia that could play a role similar to that of the Norwegian Meteorological Institute and NILU on the European scene. For both modelling and measurements of regional air pollution.*

(iii) prospects and progress of mitigation in the region(s)? *Emissions of sulfur an nitrogen pollutants are very likely to continue to increase for several years. There is a good potential for reducing direct emissions of aerosol particles from industrial processes, vehicles and from uncontrolled biomass burning.*

B. Specific information relating to your RAPIDC activity:

(i) what capacity is being built up?

CAD has contributed, albeit on a relatively modest scale, to capacity building for measuring gaseous and particulate air pollutants in rural areas in South and Southeast Asia.

(ii) What is the significance of the project

The CAD monitoring program is linked to the ABC and EANET programs. However, the link to the Malé network is still weak, partly because that network doesn't seem to involve local senior scientists and that little data have come out so far.

(iii) Draft press release;

One of the major conclusions of the CAD project is that acidification is not likely to be a serious concern during the next few decades in South and South-East Asia. This is due to the alkaline nature of the soils that tend to neutralize the acids formed from the emissions of sulphur and nitrogen oxides. This conclusion is based both on the results from the measurements of atmospheric deposition within the CAD program and other monitoring program sand on an investigation of the characteristics of soils. This result does not imply that we should not be concerned with the increasing emissions of sulphur and nitrogen pollutants in India and other Asian countries as such emissions have other harmful effects: direct damage to vegetation, formation of surface ozone, formation of aerosol particles with impacts on health and climate.

In some parts of SW China, on the other hand, soils are more sensitive and because of a very high pollution load adverse effects due to acidification of soils have already started to show up.

The positive picture regarding acidification in Asia is still tentative and has to be followed up by further investigations, in particular regarding the sensitivity of soils in different regions. The fundamental role of atmospheric aerosols for climate and health motivates an increased focus on aerosols in a possible future phase of the CAD program.

(iv) any interaction with the region in terms of help 'in kind' and financial assistance;

The financial support from Sida to our Indian partners is only to cover the marginal costs. Substantial support, both in kind and financial, from the host institutions is required for carrying out the CAD activities.

(v) progress on capacity building, ownership and sustainability

We have contributed in an important way to the supervision of one PhD student (in Bhubaneswar). She will now come to spend a postdoc period in Stockholm to learn more about air pollution

measurements and the interpretation of such data. The CAD workshop included several tutorial type lectures that were attended by local students and scientists from Hyderabad. We have provided several instruments for collecting rainwater and aerosol samples. These instruments will remain in the ownership of our Indian partners after the completion of the project. The capacity for making chemical analyses of the collected samples is continuously improving. Pending the outcome of the ongoing international inter-comparison study (organized by EANET) a decision will be made to transfer the analyses of samples from all Indian CAD stations to one of the Indian CAD laboratories.

(vi) major problems/ set backs;

The CAD coordinator has been very busy with many other projects. Resources, manpower as well as financial, for project managing has been very limited.

Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

Depending on the result of the inter-comparison study plans will be made to give one of the Indian CAD laboratories a full responsibility for future CAD chemical analyses.

I suppose that the passive sampler inter-comparison study will be reported elsewhere. Although not a CAD activity as such this project is led by the CAD co-ordinator Dr. Bala and the results may be very important for future CAD-related activities.

7. Gender, poverty and HIV/Aids issues relevant to project

No comment

8. Any other relevant comments/grievances etc

A5.4 Air Pollution in the Mega Cities of Asia

APMA Result 1. Better air quality management in Asian cities promoted and supported

RAPIDC Annual Report	**Period covered by report:** (month/year to month/year) May 2006 – April 2007
Project Title: Air Pollution in the Megacities of Asia	**Project Number:** 732305
Lead institution: SEI	**Prepared by:** Gary Haq and Dieter Schwela
Collaborating Institutions: (name; principal contact; contact details) World Health Organization (WHO), Geneva, Switzerland Dr Dieter Schwela, WHO/HQs (until 2003) United Nations Environment Programme (UNEP), Nairobi, Kenya Dr Hiremagalur Gopalan, UNEP Clean Air initiative for Asian Cities (CAI-Asia), Manila, Philippines Mr Cornie Huizenga, Mr Herbert Fabian, Ms May Ajero, CAI-Asia Korea Environmental Institute (KEI), Seoul, Republic of Korea Dr Wha-Jin Han, KEI IUCN Pakistan, Environmental Protection Agency (EPA), Islamabad, Pakistan Mohammad Aqib, Pakistan Clean Air Network, IUCN Pakistan The International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal, Bidya Banmali Pradhan, ICIMOD Environment and Public Health Organization (ENPHO), Kathmandu, Nepal Mr BhushanTuladhar, Executive Director, ENPHO	

Annual Report

I. Outline of original project

The original APMA project had two key activities:

- Support AQM strategy formation in selected Asian cities (APMA Activity 1.1)
- Development of a AQM information system for Asian cities (APMA Activity 1.2)

The PAG expressed concern over APMA's role in a regional programme and it relationship to other programme activities. This concern is responded to as follows:

- The monitoring of air pollution in cities is an important part of the activities under the Malé declaration. The Malé part of RAPIDC Phase III adds to this monitoring at remote sites. Air pollutant concentrations at remote sites are essentially determined by emissions in urban areas. This is particularly true for fine particulate matter ($PM_{2.5}$) which is fairly uniformly distributed

across urban and rural areas. In order to interpret monitoring results at remote sites, the air pollution situation in urban areas must be known. This is exactly what APMA will deliver.

- APINA Activity 2.3 refers to establishing/enhancing monitoring networks in the participating countries. If they exist at all, national air pollution networks are established only in urban areas; sometimes consisting of one station only. Thus enhancing existing monitoring networks will mean enhancing urban monitoring networks. Where monitoring is not being performed, as is the case in the majority of SSA countries, it is of little value to undertake monitoring in remote areas. Thus APINA Activity 2.3 addresses urban environment.
- In Malé Activity 3.4 an urban integrated assessment capability is to be developed. The APMA project is closely related to this activity. With respect to this, RAPIDC is not a purely regional project. The same applies for APINA Activity 2.5 in which a city will be chosen for application of rapid urban air quality assessment.

APMA's focus on urban air quality management contributes the activities in both Malé and APINA. Addressing the contribution of urban sources of emissions to regional air pollution problems is key to improving the air pollution situation in Africa and Asia.

II. Describe any deviation from original plan(s) and budget

In response to the concerns of the PAG and in view of the arguments developed in I it was decided to change the original plan and to use the insights of the Benchmarking Report, the Strategic Framework and the needs assessment for urban areas garnered in the EU Asia/Urbs training project to redirect the APMA project:

- To enhance capacity on air quality management in urban areas for a better explanation of regional data; and
- To emphasize and strengthen the close links between APMA and the Rapid Urban Assessment (RUA) project, RAPIDC Male (Activity 3.4) and APINA (Activity 2.5).

Therefore, in the second year of the programme and in collaboration with the Male activity 3.4, the cities of Kathmandu and Karachi were selected for Activity 1.1 "Support AQM strategy formation in selected Asian cities". Discussion has been undertaken with key stakeholders in each city. Dr Dieter Schwela visited ICIMOD and ENPHO in Kathmandu to finalise the work plan for this activity. Discussion has been undertaken with IUCN Pakistan and the Pakistani Environmental Protection Agency to finalise the work plan for Karachi. The activities in both cities will be undertaken in June and July 2007.

The highlight of the second year of the programme was the publication of the final benchmarking report which was launched at the Better Air Quality 2006 workshop in Indonesia. The book received considerable media coverage in Asia and internationally. It was reported by many national quality newspapers including the International Herald Tribune and the Financial Times.

The benchmarking study has provided the foundation to Activity 1.2 'Development of an AQM information system (AMIS-Asia) for Asian cities'. The aim of this activity is to develop an information system for the standardised collation of AQM information for Asian cities. It will facilitate the transfer of AQM and best practice between countries and cities to support decision-making processes and strategy formation.

Work has started on examining how this information can provide an accessible web-based database.

Due to the re-aligning of the APMA project with the RUA project of the Malé Declaration and du to the time taken to establish contact with authorities in Karachi, the financial pull-down has been slower than expected, but it is expected that the full budget will be used by the end of Phase III.

III. Results, outcomes and deliverables

The work of the benchmarking has culminated in the publication of the book "Urban Air Pollution in Asian Cities". Authors: Schwela, D., Haq, G., Huizenga, C., Wha-Jin Han, Fabia, H., Ajero, M.; Earthscan, 2006.

IV. Assessment and analysis of progress:

The aim of this activity is to support the development and implementation of comprehensive AQM in a selected Asian city with the APMA/CAI-Asia network (APMA Activity 1.1) and to develop an AQM information system (AMIS-Asia) for Asian cities (APMA Activity 1.2). This activity will be in parallel to that undertaken within the Malé Declaration activity, which provides a much detailed assessment of selected Malé Declaration cities by employing rapid urban assessment techniques.

In the last RAPIDC Phase II APMA in collaboration with CAI-Asia developed a Strategic Framework (SF) for AQM in Asia. The Framework was the result of a two-year process which involved two multi-stakeholder dialogues, four country consultations meetings and wide dissemination for comments. The SF identified the key challenges for AQM that are unique to Asian cities and outlined the key components of a comprehensive AQM system. Parallel to the SF a benchmarking report was performed in which the capabilities in AQM of 20 Asian cities were assessed. The cities where categorised according to their current stage in AQM development.

This activity will support the development and implementation of the SF in Kathmandu and Karachi which were identified by the benchmarking study as having limited AQM.

For one week in May 2007 five dustTraks will be made available to ICIMOD/ENPHO in Kathmandu. The dustTrak Aerosol Monitor is a portable, battery-operated laser photometer with real-time mass concentration readout and data logging capability. The monitor provides reliable exposure assessment by measuring particle concentrations corresponding to respirable size, PM10, PM2.5 or PM1.0 size fractions.

The dustTraks were purchased in March 2007. From June 2007 onwards two of them will be left on loan (free of charge) for one year until the end of the RAPIDC programme in April 2008.

Objectives for Kathmandu

1) To undertake a needs assessment in Kathmandu with respect to air quality management (AQM) capabilities.
2) As a follow-up of the training courses of Asia Urbs and of the Male Declaration activity 4.1 local staff is to be trained more specifically in the use of DustTraks and the provision of data which are quality assured. This more specialised training will cover the main elements of a QA/QC programme for PM monitoring laid down in a manual.
3) Test of accuracy, precision and reproducibility of IVL passive PM_{10} samplers by inter-comparison in a study of maximal duration of the IVL campaign

4) Test of compliance of 24-hour PM_{10} concentrations with air quality standards at two additional sites in Kathmandu. At these sites the daily variation of PM_{10} should be determined to allow estimate to peak to mean/median ratio. To monitor PM_{10} during a year at these sites in Kathmandu valley, which are not coincident with sites of MOEST stations, for the purpose of deriving an annual mean and compare it with an annual standard. Information should be obtained for 24 hours to enable compliance testing of concentrations with a PM_{10} air quality standard or guideline value. Daily peaks should be identified. After one year statistical parameters should be calculated.

5) To get an indication of the $PM_{2.5}/PM_{10}$ ratio at two sites in Kathmandu south-east and northeast of the city centre and the magnitude of PM_1 at the most polluted MOEST station.

6) To evaluate collected data and with respect to the five objectives quoted above.

7) To develop an AMIS-Asia structure and collect information on summary statistics and best practices in an interactive web-based database.

Implementation

Objective 1: The needs of Kathmandu with respect to AQM were assessed within the framework of the Asia Urbs training course. A report is available.

Objective 2: A two day training course for the staff of ICIMOD and MOEST involved in monitoring will be prepared covering the features of the DustTrak monitoring devices and issues of QA/QC.

Objective 3: The IVL passive PM10 monitors will be exposed for one week each. Two DustTrak monitors will be exposed for the same period (provided the batteries of the "Environmental Enclosure" last that time). The sites of exposure of the DustTraks will be in residential areas north-east and south-east, respectively, of the centre of the city. The elevation of monitors should be 1.5 – 2 m above ground. If this is not possible, the roof of the building or some other 'appropriate' location is to be selected. Two IVL passive PM_{10} samplers should be exposed at these sites and elevations for the duration of the campaign in a distance which ensures that the results of monitors are not mutually affected. Weekly concentration values from the IVL devices and the DustTraks will be compared, Spearman correlations evaluated and arithmetic and geometric means, standard deviations and medians over the period of campaign duration estimated. The implementation of this investigation will start after the implementation of objective 5.

Objective 4: The two Dustraks will continue to be exposed at the selected sites. They will be exposed for 24 hours, either each day or on selected days three times a week. Data stored in the device will be transferred to a laptop. This transfer will be performed before storage space of the device will be exhausted. A detailed work plan including QA/QC procedures will be developed. 24-hour averages will be compared with the air quality standard. The implementation of this investigation will start after the implementation of objective 1.

Objective 5: During one week two Dusttraks will be exposed at two sites in the northeast and southeast of Kathmandu centre. One of each will be monitoring PM_{10} and the other one $PM_{2.5}$ Monitoring of PM_{10} and $PM_{2.5}$ is performed during a 1-week campaign at the two sites in parallel, and PM_1 at the most polluted MOEST station. Exposure time will be 24 hours. The concentrations will be compared with existing standards and guideline values. The site of highest pollution is identified by determining the maximum of monthly means of MOEST data in the last available year. On the end of the week data will be evaluated, ratios determined and set into context with results from other studies.

Objective 6: All collected data will be evaluated to test compliance with air quality standards and to test the applicability of the IVL passive PM monitor.

Objective 7: The activity has been initiated. A user-friendly interactive interface is being developed.

Outputs

- Needs Assessment report
- Evaluation of training from participants
- Workshop with stakeholders from ICIMOD and ENPHO
- Support to the AQM action plan for Kathmandu
- Report on the results of data gathering
- A developed AMIS Asia structure and interactive web-based database on AQM information

Annex: Results of a meeting with ICIMOD and ENPHO staff

14.02.2007: Meeting with Bidya Banmali Pradhan, Basanta Raj Shrestha, ICIMOD

14.02.2007: Meeting with Khum Raj Punjali, Narendra Prasad Pokhrel, Chhewang Lama, Batu Krishna Uprety, Bidya Banmali Pradhan.

Discussion of needs of Kathmandu and other Nepali cities.

At present, air pollution monitoring is being performed only in Kathmandu a six governmental sites. Variables are PM_{10}, NO_2 and CO.

1. It is wished to monitor also in other cities, i.e. Pokhara, Birguij, Biratnagar, Nepalganj.
2. Training of staff in other cities is necessary in order to achieve the goal of 1).
3. Health impacts corresponding to present air pollution in Kathmandu should be assessed.
4. Spatial coverage of monitoring network through passive samplers for CO, NO_2, and O_3 seems useful.
5. If a strong correlation can be established between the monitoring devices at the six governmental stations, some of these stations could be redundant and might be used outside the valley. This will be tested by data evaluation using SPSS routines. UNEP/AIT will be asked if they can provide the statistical package.
6. IVL will use about 40 passive monitors for SO_2, NO_2, O_3, and PM during a monitoring campaign of 2-3 months. The passive PM monitor has to be assessed with respect to its accuracy, precision, and reproducibility (QA/QC approach).
7. The sustainability of the IVL campaign is to be discussed.
8. SEI will provide on loan for a period of one year one or two DustTraks for
    a. Assessing the viability of the passive monitor of IVL as a means of PM monitoring in Kathmandu
    b. Use of this (these) monitor(s) at stations northeast and southeast of the centre of Kathmandu, in complementation to the ENPHO stations.
9. ICIMOD will search appropriate sites for monitoring with dustTrak(s) according to the work plan above.

Objectives for Karachi

1. To undertake a needs assessment in Karachi with respect to air quality management (AQM) capabilities.
2. Training of local staff in the use of DustTraks and the provision of data which are quality assured. The training will cover the main elements of a QA/QC programme laid down in a manual.
3. Test of compliance of 24-hour PM_{10} or $PM_{2.5}$ concentrations with air quality standards or guidelines at two sites in Karachi. At these sites the daily variation of PM_{10} should be determined to allow estimate to peak to mean/median ratio. To monitor PM_{10} during a year at these sites in Karachi, which are not coincident with sites of JICA-funded stations, for the purpose of deriving an annual mean and compare it with an annual standard or guideline. Information should be obtained for 24 hours to enable compliance testing of concentrations with a PM_{10} air quality standard or guideline value. Daily peaks should be identified. After one year statistical parameters should be calculated.
4. To evaluate collected data and with respect to the five objectives quoted above.

Implementation

Objective 1: The needs of Pakistan cities with respect to AQM were assessed within the framework of the Asia Urbs training course. A report is available.

Objective 2: A two day training course for the staff of ICIMOD and MOEST involved in monitoring will be prepared covering the features of the DustTrak monitoring devices and issues of QA/QC.

Objective 3: Test of compliance of 24-hour PM_{10} concentrations with air quality standards at two sites in Karachi which do not coincide with the sites of the monitoring network installed recently by JICA. At these sites the daily variation of PM_{10} should be determined to allow estimate to peak to mean/median ratio and monitor PM_{10} during a year at these sites, for the purpose of deriving an annual mean and compare it with an annual standard. Information should be obtained for 24 hours to enable compliance testing of concentrations with a PM_{10} air quality standard or guideline value. Data stored in the datalogger will be transferred to a laptop. This transfer will be performed before storage space of the device will be exhausted. A detailed work plan including QA/QC procedures will be developed. 24-hour averages will be compared with the air quality standard. The implementation of this investigation will start after the implementation of objective 1.

Objective 4: All collected data will be evaluated to test compliance with air quality standards.

3. Results, outcomes and deliverables

- Needs Assessment report
- Evaluation of training from participants
- Workshop with stakeholders from IUCN and Pakistan EPA
- Support to the AQM action plan for Karachi
- Report on the results of data gathering

A. General information and context concerning the issue being addressed by the RAPIDC activity:

(i) What is the status of the issue in the relevant region?

- *How important to impacts?*

The collected data will allow estimate population exposure and expected health and environmental impacts in urban areas. It will also permit a better explanation of rural data.

- *How important is it politically?*

The collected data and health and environmental impact estimates will allow decide on action to reduce local and regional air pollution if standards or guideline values are exceeded.

- *What is the awareness of the issue?*

Awareness in the general population in urban areas in Asia and, in particular, Africa is low.

- *Has there been a change in awareness/relevance of the issue in the region(s) in the last ten years?*

Yes, awareness has been raised.

- *What is the knowledge about this issue in the region? i.e. how would you describe the current level of understanding of the issue in the region(s) and what gaps remain to be filled?*

The knowledge in Africa is limited to a few experts per country. In Asia, knowledge is broader but still has not yet reached levels of developed countries.

- *What is the level of capacity to study this issue in the region?*

In Sub Saharan Africa and in the less developed countries in Asia the level of capacity is low.

(ii) What are the capacity enhancement and assessment needs – institutions, activities and personnel and the importance of data quality etc?

Capacity enhancement needs include QA/QC; emissions inventories; dispersion modelling; educated personnel, and funding.

(iii) Are there major trends for the issue in the region(s) that you can identify?

Air quality is deteriorating in urban and consequently rural areas.

(iv) For impacts, what are the prospects and progress of mitigation in the region(s)?

With regards to outdoor air pollution the only possible mitigation is to reduce air pollution in urban areas.

(v) The significance of the regional approach – needs, advantages, data exchange, personal – professional linkages etc.

The significance of the regional approach includes:

- Common problems and needs across countries;
- Advantages of finding solutions for transboundary air pollution through sharing of information;
- Knowledge and technology transfer through personal-professional linkages.

B. Specific information relating to your RAPIDC activity:

Through exchange of information and knowledge and the development of regional action plans transboundary air pollution caused by emissions from urban areas can be reduced and impacts mitigated.

Capacity of local authorities is being enhanced by training on QA/QC and monitoring of particulate matter.

The air pollutant monitoring relates to national monitoring networks (if they exist) and to the rapid urban air quality assessment activity. By assessing particle concentrations and comparing with air

quality standards or guidelines the size of the problem can be quantified and cost-effective measures be taken.

(ii) a summary of substantive progress;

Substantive progress includes:

- Benchmarking report for 20 Asian cities
- Needs assessment report for Kathmandu and Karachi

(iv) progress on capacity building and ownership detailing prospects for sustainability of built capacity;

Training on AQM has been performed for staff from national authorities in Nepal and Pakistan

(v) major problems/ set backs;

None

(vi) recommendations for improvements

More dedicated funding would be beneficial.

5. Linkages within the RAPIDC Programme and to other relevant initiatives in the region(s)/internationally

Within the RAPIDC programme there is a link between APMA and RUA (Rapid Urban Air Quality Assessment). For Malé countries, there are linkages to the Asia Urbs project of SEI (training on AQM in less developed countries of Asia) and to the Clean Air Initiative for Asian Cities (CAI-Asia). For APINA countries there is a linkage to the Clean Air Initiative for Sub Saharan African Cities (CAI-SSA).

6. Future development (next 6 months and beyond into the next phase) and issues related to the handover of ownership during Phase III

The following activities will be undertaken in the next 6 months:

Training of staff in Kathmandu in the use of PM monitoring devices (DustTraks) and QA/QC procedures

Test of accuracy, precision and reproducibility of IVL passive PM_{10} samplers by inter-comparison in a study of maximal duration of the IVL campaign.

Test of compliance of 24-hour PM_{10} concentrations with air quality standards at two additional sites in Kathmandu. At these sites the daily variation of PM_{10} will also be determined to allow estimate to peak to mean/median ratio.

To get an indication of the $PM_{2.5}/PM_{10}$ ratio at two sites in Kathmandu south-east and northeast of the city centre and the magnitude of PM_{10} at the most polluted MOEST station.

Training of staff in Karachi in the use of PM monitoring devices (DustTraks) and QA/QC procedures

Test of compliance of 24-hour PM_{10} concentrations with air quality standards at two additional sites in Karachi. At these sites the daily variation of PM_{10} will also be determined to allow estimate to peak to mean/median ratio.

The APMA project, in collaboration with the RUA project, can help develop clean air implementation plans in urban areas and thus mitigate the impacts of air pollution on human health and the environment. The handover of ownership can be easily accomplished.

7. Gender, poverty and HIV/Aids issues relevant to project

As women and children are among vulnerable groups the reduction of air pollution will ameliorate their exposure and health impacts. Since poor people are usually the people exposed most to air pollution they will benefit from AQM measures.

8. Any other relevant comments/grievances etc

None

Presentat

Visible ... of the Program
+ Has it become central or is it still a peripheral project
binding policy instruments both Int. + National
- Long term policy framework to be developed. - Policy development + what Policies are relevant
- Grounding to be reached - Think about broader policy concept
- How embedded is it in the radarscreen

Dinner at Clas på Hörnet < Surbrunnsgatan Birger, Carlsgatan

Atmospheric Environment Programme

The Atmospheric Environment Programme of SEI aims to inform, facilitate and interact with policy processes that limit pollutant emissions to the atmosphere. It carries out research to quantify and model emissions and impacts and assess mitigation options. This information is transferred to policy- and decision-making processes at different scales through networking and multi-stakeholder dialogues. Further activities enhance the capacity to implement international agreements, particularly in developing countries. The Programme concentrates on local and regional air pollution problems in Europe, Asia and Africa. It also builds capacity in developing countries and countries in transition to phase out ozone-depleting substances.

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Regional Air Pollution In Developing Countries

RAPIDC is a Programme funded by the Department of Infrastructure and Economic Cooperation (INEC) of Sida, the Swedish International Development Cooperation Agency. It is co-ordinated by SEI and carried out in collaboration with Swedish universities and research organisations together with inter-governmental agencies and research organisations in Asia and Africa. The aim of RAPIDC is to facilitate the development of agreements/ protocols to implement measures which prevent and control air pollution. Projects are carried out that facilitate international co-operation on air pollution issues and develop relevant knowledge to support decision making. Activities are carried out in Asia (mainly South Asia) and in Southern Africa.

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