

# **THE AIR POLLUTION INFORMATION NETWORK FOR AFRICA (APINA): ACTIVITIES PROMOTING REGIONAL CO-OPERATION ON AIR POLLUTION ISSUES IN SOUTHERN AFRICA**

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## **ABSTRACT**

In 1998, the Air Pollution Information Network for Africa (APINA) convened a regional multi-stakeholder policy dialogue on air pollution held in Harare, Zimbabwe. The outcome of this policy dialogue was the 'Harare Resolution on Prevention and Control of Regional Air Pollution in southern Africa and its likely transboundary Effects'. Since this time seven countries in southern Africa (Botswana, Malawi, Mozambique, South Africa, Tanzania, Zambia and Zimbabwe) have produced country status reports on air pollution and participated in air pollution related projects and events in the region. APINA has also developed close links with other important regional initiatives such as the Southern African Regional Science Initiative (SAFARI 2000) and the Cross Border Air Pollution Impact Assessment (CAPIA) whose experimental and modelling work demonstrate the transboundary nature of the air pollution problem in the region. In 2003, APINA convened a second regional multi-stakeholder policy dialogue (attended by two Ministers of Environment), which resulted in the formulation of the draft 'Maputo Declaration on the Prevention and Control of Regional Air Pollution in southern Africa and its likely Transboundary Effects'. An organizational structure, which facilitates information flow to ministries of environment at both national and regional levels, was agreed upon as part of the draft Declaration and National Focal Points for air pollution issues, in the ministries have been established.

This paper describes APINA's development in southern Africa as well as results from recent activities, including a health study scoping report, crops and natural ecosystems scoping report, air quality monitoring around a smelter in Zambia, participation in an international corrosion exposure and hosting of a regional policy dialogue.

## **INTRODUCTION**

The Air Pollution Information Network for Africa (APINA) was formed to address issues related to Air pollution in southern Africa. It is a network of Scientists, Policy-makers, Industry and Non-Governmental Organisations (NGOs). A similar network exists in Asia for the implementation of what is known as the Malé Declaration. These networks are part of a Regional Air Pollution in Developing Countries (RAPIDC) programme, coordinated by Stockholm Environmental Institute (SEI) and funded by the Swedish International Development Co-operation Agency (Sida).

The APINA network aims to form a strong link between the air pollution scientific community and policy makers at national and regional levels. It acts to transfer knowledge and data derived in the scientific programmes and existing research to influence policy and decision-makers in matters related to air pollution. Currently, APINA links different networks and programmes on air pollution in southern Africa and in the future aims to cover the whole of Africa.

APINA has identified focal problems for air pollution activities in southern Africa as:

- To fill the gaps in knowledge in southern Africa concerning the extent and impacts of air pollution
- To ensure that current knowledge about air pollution is adequately reflected by national and regional policy development.

The overall objective of APINA, therefore, is to contribute towards reduction of air pollution in Africa and its specific objectives are to:

- provide technical assistance for the development of protocols on environmental issues in (southern) Africa.
- build capacity in the region for the assessment of air pollution impacts.
- collate information on the impacts of air pollution on the ecosystems, agriculture, corrosion of man-made materials and human and animal health.
- disseminate information on air pollution.
- network on air pollution issues.

APINA convened a regional multi-stakeholder policy dialogue on air pollution in Harare, Zimbabwe, in September, 1998. The outcome of this policy dialogue was the 'Harare Resolution on Prevention and Control of Regional Air Pollution in southern Africa and its Likely Transboundary Effects'. Since this time seven countries in southern Africa (Botswana, Malawi, Mozambique, South Africa, Tanzania, Zambia and Zimbabwe) have collated information on air pollution issues and participated in air pollution related projects and events in the region. APINA has also developed close links with other important regional initiatives such as the Southern African Regional Science Initiative (SAFARI 2000) and the Cross Border Air Pollution Impact Assessment (CAPIA) whose experimental and modelling work demonstrate the transboundary nature of the air pollution problem in the region. APINA coordinates the Harare Resolutions follow-up.

## **AIR POLLUTION IN SOUTHERN AFRICA**

Impacts of air pollutant emissions are increasingly taking their place amongst the major environmental and social issues facing southern Africa [1]. Unlike some of the other major problems there is a high chance that the air pollution problems can be solved. APINA wishes to tackle the existing problems but also attempts to ensure that developing air pollution problems are prevented.

Southern Africa, as is the case on the African continent, has transformed from a rural society to a complex society and has made great strides towards industrialisation, urbanisation and economic development, in general. Economic growth and a growing population, has brought environmental problems that were virtually non-existent at the turn of the 20<sup>th</sup> Century [2]. Southern Africa is one of the fastest developing regions in Africa. Economic growth depends on energy, which, in the Southern African Development Community (SADC) countries, is mostly met by coal and fuel wood.

Country reports on the status of air pollution in seven southern African countries (Botswana, Malawi, Mozambique, South Africa, Tanzania, Zambia and Zimbabwe) commissioned by APINA in 2002 have given the status of air pollution in southern Africa. Some of the highlights are given in the following paragraphs.

### **Energy Sources**

Twelve different energy sources are used in SADC countries: coal, fuel oil, kerosene, jet fuel, LPG, gasoline, ethanol, fuel wood, charcoal, dung, biogas and hydropower. Fuel wood constitutes around 50% of total energy use, and for rural households provides over 90% of energy needs [3]. Practices such as fuel wood burning for domestic use and grassland burning for grazing are widespread in the SADC region. Emissions from these activities are estimated to be of a comparable scale to industrial emissions [4].

Solid fuels used for cooking without adequate ventilation or chimneys leads to high levels of indoor air pollution. Reports from some SADC countries show that there is still widespread use of charcoal, kerosene, animal dung, and wood fuel in the region for cooking and lighting purposes. People are exposed to the products of combustion such as CO, SO<sub>2</sub>, NO<sub>x</sub>, and PM in unventilated conditions. Studies on indoor air pollution have been conducted in South Africa and Zambia, but there is still a lack of detailed studies relating indoor air pollution to health effects. In Zambia, 85% of all households use wood fuel & it accounts for about 68% of the total national energy consumption. This has led to a lack of urgency amongst some policy makers leading to limited action to tackle this problem.

### **Sectors Emissions**

Increasing activity in different sectors is evident. The transport sector has been expanding rapidly, for example, there has been a doubling of car fleets in 10 years in Zimbabwe and Botswana [5,6]. Generally, these are not modern cars but reconditioned old cars discarded in industrialised countries and there is a continuing problem of lead additives in petroleum. Significant emissions also emanate from an active metal smelting sector and increases in the power generation sector, based mainly on coal, in the region.

### **Impacts**

Impacts are experienced at different scales in southern Africa. Health may be affected due to inhalation of indoor air pollution - cooking in an enclosure without a chimney, due to outdoor exposure to air pollution, particularly in urban areas and close to point sources. Corrosion is another important impact due mainly to locally emitted pollutants.

Crop yields may be affected close to urban centres and point sources, but ozone can also affect yields on a regional scale. Long-range transfer of sulphur dioxide, nitrogen and ozone in the atmosphere over hundreds of kilometres may lead to impacts on natural ecosystems far from the point of emission.

## **Urban air quality**

Urban air quality has deteriorated in urban centres. There is an increasing number of exceedances of WHO guidelines for health related to several pollutants. Most notable ones are sulphur dioxide, nitrogen oxides, particulate matter and lead. Information on air pollution concentrations and impacts in most Southern African countries is documented in the reports produced by APINA Country Representatives in 2002.

Near the point sources of pollution, SO<sub>2</sub> and particulate matter exceed health guidelines for local people. For example, SO<sub>2</sub> in concentrations exceeding 1000 µgm<sup>-3</sup> affects people 15 km distance on the downwind of a major smelter in Selebi Phikwe, Botswana - WHO guideline 350 µgm<sup>-3</sup> (24-hour). Similar situations are experienced in the mining towns in Kitwe and Mufulira in Zambia. Other mining towns with smelter experience similar trends.

Apart from health impacts, corrosion impacts have been demonstrated - full extent of the problem in southern Africa is unknown but is currently being investigated by APINA.

## **Vegetation**

The country reports show that vegetation has been impacted at the point sources of pollution. The evidence is assessed from simple observation. It was noted that the vegetation in Botswana is missing or sparse close to the smelter compared to other areas. Within a 40 km radius of the Mufulira Smelter in Zambia it was noticed that vegetation sensitive to SO<sub>2</sub> pollution was not common, whereas they were common away from the plume. Ozone concentrations are currently comparable to levels that caused crop yield reductions in Europe. There are fears about impacts of ozone on crops over large parts of the region.

## **RESULTS OF APINA AIR POLLUTION IMPACT ASSESSMENTS**

APINA has been carrying out some air pollution impact assessments in southern Africa to determine the extent of impacts with a view to establishing gaps in knowledge and generating data to be used as a basis for APINA activities in fulfilling its objectives. Some of the results of the impacts assessments are discussed in the following paragraphs.

### **Crops and natural ecosystems**

Emission of pollutants to the atmosphere from one place can result in impacts both close to and at great distances from the source. Studies involving APINA members have demonstrated that air pollution concentrations in southern Africa exceed thresholds at which plant damage can occur. There is however lack of evidence to indicate the seriousness of this problem in the region. Evidence from other regions, in particular Europe and North America, suggests that the current concentrations of pollutants in southern Africa could be causing significant damage to ecosystems and agriculture with associated loss of earnings.

## **Corrosion**

The costs of deterioration of the different materials used in construction due to air pollution are huge, as has been shown for Europe. The damage to cultural artifacts caused by air pollution endangers cultural heritages. APINA is currently conducting experiments in Zambia, Zimbabwe and South Africa that will contribute to the understanding of the socio-economic costs of corrosion impacts in southern Africa. Countries in southern Africa should seriously embark on a programme that will establish a database of stock-at-risk. The database should also include information on material maintenance costs and lifetimes.

## **Kitwe Health Study**

An air quality mapping campaign was undertaken in the Kitwe area of the Copperbelt of Zambia using diffusive samplers for sulphur dioxide (SO<sub>2</sub>) and nitrogen dioxide (NO<sub>2</sub>). In addition, some indoor and personal exposure sampling was carried out. The main objective was to obtain information about the pollution levels in the area

The SO<sub>2</sub> concentration levels, measured as 2-week means, within the smelter plant area were well in excess of the World Health Organisation (WHO) and Zambian 24 hour guideline value (125 µg/m<sup>3</sup>). The workers at the smelter plants were all exposed to SO<sub>2</sub> concentrations >2,000 µg/m<sup>3</sup> as a mean value during a 40 hours working week, which is well above the WHO and Zambian guideline value as a 10 minutes mean value, 500 µg/m<sup>3</sup>.

The SO<sub>2</sub> levels at the industrial sites exceeded 350 µg/m<sup>3</sup> (Zambian 1 hour guideline value) as well as 500 µg/m<sup>3</sup> (WHO and Zambian 10 minutes guideline value). The observed concentrations of SO<sub>2</sub> indicate that the large emissions of SO<sub>2</sub> from the industrial area cause exceedances well above the air quality guidelines for health.

During the measurement campaigns most of the residential areas in the town experienced concentrations above the WHO annual guideline for SO<sub>2</sub> (50 µg/m<sup>3</sup>). The indoor SO<sub>2</sub> concentrations were significantly lower than at the nearby outdoor measurement sites, which indicates that outdoor sources of sulphur dioxide do not significantly contribute to indoor exposure.

Concentrations of NO<sub>2</sub> in Kitwe were found to be well within the WHO annual mean guideline of 40 µg/m<sup>3</sup>, mainly below 15 µg/m<sup>3</sup>. Concentrations of NO<sub>2</sub> at the nearby outdoor stations were similar in the residential areas as well as within the smelter plant.

## **Regional Policy Dialogue**

The Air Pollution Information Network for Africa (APINA) organized a Regional Policy Dialogue (RPD) in Maputo, Mozambique, which took place during 22<sup>nd</sup> to 24<sup>th</sup> September 2003. The major objective of the RPD was to move towards a regional policy process on air pollution in the southern African region.

Specific objectives were to:

- Define the stages to move towards policy formulation in southern Africa;
- Translate and transfer scientific information to the policy process in the region;
- Define the information gaps;
- Define the structures that can be developed to facilitate the regional policy process.

Policy makers from the seven participating countries: Botswana, Malawi, Mozambique, South Africa, Tanzania, Zambia and Zimbabwe attended the meeting. Zambia and Mozambique were represented at ministerial level. Other participants included APINA country representatives, APINA members, air pollution scientists and representatives from the Southern African Regional Science Research Initiative (SAFARI 2000) including those from the National Aeronautics and Space Administration (NASA) of the United States of America.

Two major outcomes were achieved by the RPD [7].

a) The delegates at the RPD agreed on the draft *'Maputo Draft Declaration on the Prevention and Control of Air Pollution in Southern Africa and its likely Transboundary Effects'*. In it the delegates declare:

*that we shall:*

*Endeavor to promote national reporting systems and strengthen scientific and academic efforts in the understanding and tackling of air pollution issues;*

*Continue this process in a coordinated manner and in stages with mutual consultation to draw up and implement national and regional action plans and protocols based on a fuller understanding of transboundary air pollution issues;*

*Endeavour to promote the philosophies and practices of cleaner production, waste management to enhance sustainable development in the region.'*

b) Participants agreed on mechanisms of how scientific information on air pollution issues can reach policy makers both at national and regional levels. To this effect a new APINA structure was agreed upon which promotes constant dialogue with the Ministries of Environment through appointment of National Focal Points within the ministries. These have already been appointed for 6 countries and will be national coordinators of key stakeholders on air pollution issues.

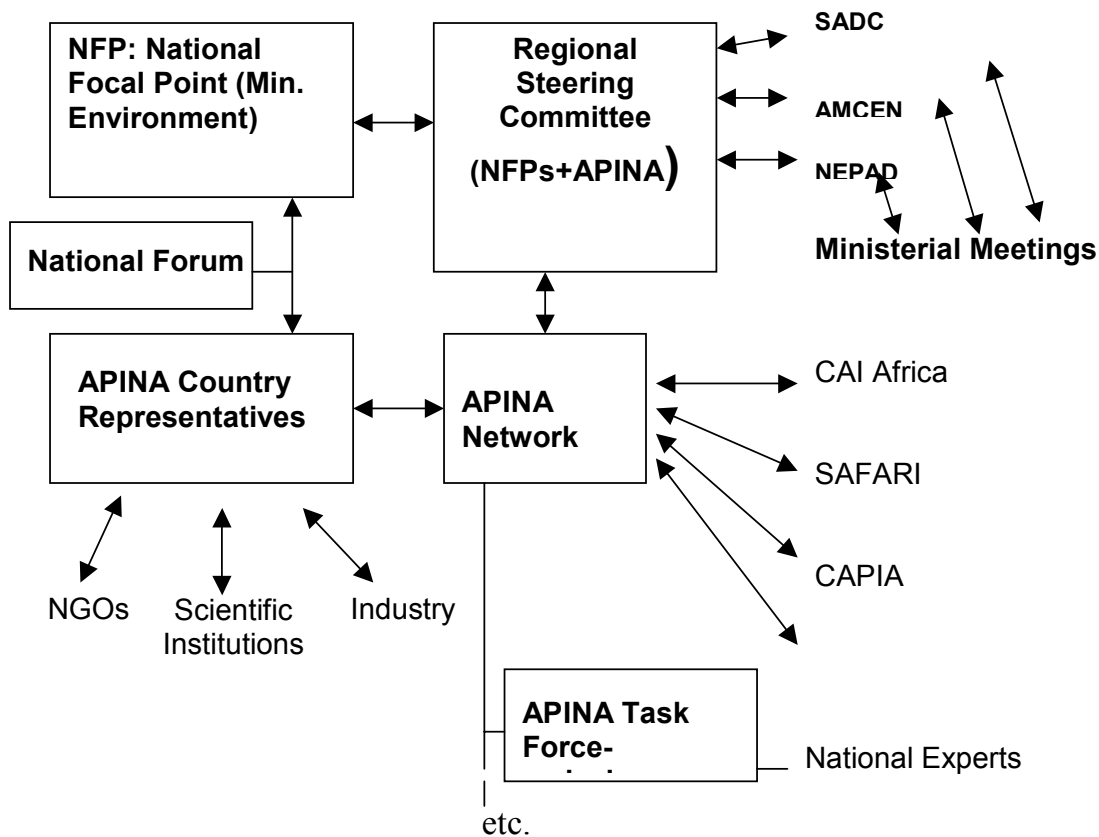


Figure 1: New APINA structure which includes National Focal Points in Ministries of Environment

Avenues to have the Draft Maputo Declaration adopted by regional governmental bodies like the Southern African Development Community (SADC) and the New Partnership for African Development (NEPAD) are being pursued.

## CONCLUSIONS

Impacts of air pollutant emissions are increasing in southern Africa. APINA is starting to establish an information base but this is still limited. There is need to:

- Develop a comprehensive emissions inventory for the region that can be used to predict deposition of air pollutants now and in the future, which APINA has started to address.
- Quantify impacts in terms of socio-economic effects.
- Establish regionally appropriate mitigation strategies.
- Realize further regional funding to sustain the policy process.
- Further disseminate information to key stakeholders and policy makers.

Air pollution issues must be on the political agenda in southern Africa to avoid the serious impacts experienced in Europe, North America and Asia.

Apart from the need for an emissions inventory, what are needed in the future are scenarios to describe the likely development of air pollution emissions. Knowledge of the prevention and control options in different sectors can show how different policies may achieve cleaner air and depositions that do not pose a threat to the environment. The emphasis on preventive measures will show how countries of the regions may be able to leap-frog and avoid high pollution scenarios in their development.

The major problem to be tackled is that the current extent and impact of air pollution in southern Africa is poorly understood and the future development of these problems, including the required policy responses, is unclear.

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