State of Air Report 2005

A report on the state of the air in South Africa

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environmental affairs
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Environmental Affairs
REPUBLIC OF SOUTH AFRICA

FOREWORD

2005 was a significant year for air quality and air quality management in South Africa in that the then Minister of Environmental Affairs and Tourism brought the new Air Quality Act (AQA), the National Environmental Management: Air Quality Act (Act no. 39 of 2004) into effect.

From 1965 to 2005, the approach to air quality management in South Africa was informed and driven by the Atmospheric Pollution Prevention Act (APPA) (Act no. 45 of 1965). For many years, this Act was regarded as ineffective for a number of reasons, not least of which was the broadly-held belief that APPA, and specifically the way APPA was implemented, had not defended South Africa's air quality from the emergence of various air pollution "hotspots" around the country. In essence, the emergence of these hotspots is often considered to be a result of APPA's specific focus on individual source emissions without effectively considering the accumulative impacts of these emissions.

In this regard, the Constitution's Bill of Rights directly challenged the APPA approach by focusing on the quality of the environment and, by extension, the quality of the ambient air that we breathe. Government's Integrated Pollution and Waste Management Policy (IP&WM) 2000, put a further nail in APPA's coffin by requiring a new approach to air quality governance – an approach that used improved ambient air quality as the objective for governance.

To this end, the AQA marks a sea-change in South Africa's approach to air quality management, an approach that is now fully aligned with international best practice. In essence, the AQA sets the targets for air quality management in the form of national ambient air quality standards and then provides a host of regulatory tools to assist government in meeting these targets.

The promulgation of the AQA also marked a new vitality in the air quality management sector and we have witnessed, among many others: a number of air quality monitoring networks being established across the nation; the identification of national priority areas, plans for improving the air quality in the Vaal Triangle Airshed Priority Area published and plans for improving the air quality in the Highveld Priority Area at an advanced stage of development; the establishment of the 2007 National Framework for Air Quality Management; intergovernmental coordination and cooperation structures set up; various provinces and municipalities gearing themselves up to meet their air quality challenges; all sectors of society actively participating in standard-setting and planning processes; and the new South African Air Quality Information System (SAAQIS) starting to provide South Africans with access to national air quality information.

However, the proof of the pudding is in the eating – will the AQA prove more effective than APPA in ensuring ambient air quality that is not harmful to health and well-being?

This brings us to the significance of this document – the first South African State of the Air Report has been specifically aligned with the entry into effect of the AQA to provide all South Africans with a picture of what South Africa's air looked like at that time. In so doing, it also effectively provides the base-line for performance measurement.

Thus, the publication of this document provides a transparent means of establishing whether the AQA, and government's implementation of the AQA, progressively ensures ambient air quality that is not harmful to health and well-being.

Notwithstanding the above, this State of the Air Report 2005 also provides a detailed reference work for all South Africans who want to know more about the air they breathe and, in so-doing, aims to deepen our democracy by providing the means for informed participatory air quality governance.

PETER LUKEY
NATIONAL AIR QUALITY OFFICER

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INTRODUCTION

The atmosphere is a shared resource. The quality of air depends on the quantities of natural and human-induced (anthropogenic) emissions to the atmosphere, as well as on the potential for dispersing and removing pollutants from the atmosphere. Air pollutants vary according to the impact that they have as well as the length of time they remain in the atmosphere.

Gases such as methane, nitrous oxide, and chlorofluorocarbons are long-lived and internationally significant because of their implications for global warming and stratospheric ozone depletion. The problem posed by carbon dioxide (CO_2) is that anthropogenic generation is faster than environmental re-utilization, and leads to a rise in atmospheric concentration, with consequent impact on global warming. Pollutants such as nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO), and particulate matter (PM) are significant, primarily in terms of local human health impacts. These gases also have local and regional ecological impacts.

The purpose of *State of Air for South Africa, 2005* is to give an overview of the state of air quality in South Africa, providing insight into the sources of emissions, and their associated health, welfare, and broader environmental effects. The identification of significant sources, pollutants, and impact areas is an important first step towards air quality management. The report also summarizes current air quality management practices, and explores opportunities for reducing emissions and improving the quality of the air. Although it focuses mainly on criteria (common) pollutants as per national framework and local and urban ambient air pollution issues, the report also refers to non-criteria pollutants, regional and global challenges, and health risks posed by exposure to indoor air pollution.

In characterizing the national state of air quality, reference is made to available information from source inventories, ambient air quality monitoring stations, and relevant literature. Air quality monitoring data for over 120 stations across the country were obtained for the purpose of informing *State of Air for South Africa, 2005*. All available data for the period 1994–2004 were collected.

In the supplementary report entitled *Technical Compilation to Inform the State of Air Report* (DEAT, 2006a), a detailed description of the entire dataset is given, and the quality of the data evaluated. Summary statistics are presented for all the data collected. This technical support document covers air quality monitoring activities and presents trends at all stations at which adequate data were



collected. Air quality trends for selected air pollution monitoring stations were extracted for inclusion in the *State of Air Report 2005* to illustrate the state of air in local environments, for example in heavy industrial areas, dense low income settlements, and areas where the roads carry high volumes of traffic.

Air quality management and sustainable development

The international challenge for air quality management is not simply to provide cleaner air, but to do so without detrimental effects on society and the economy. The National Environmental Management: Air Quality Act (AQA) (Act no. 39 of 2004), pledges the country to prevent (in practice, to minimize) pollution, and to improve and maintain air quality concomitant with socio-economic development, and not at (unacceptable) expense to such development. The stated objective of this act is to protect the environment by providing reasonable measures for (a) the protection and enhancement of the quality of air in South Africa; (b) the prevention of air pollution and ecological degradation; and (c) securing ecologically sustainable development while promoting justifiable economic and social development.

Emissions are released into the atmosphere by natural processes as well as by human processes and activities

Realizing the AQA's vision will require careful structuring of the regulations being developed and implemented under this framework act. To support regulatory development and implementation, reference is made to the experience gained and lessons learned by nations abroad, where air quality management has been refined and implemented over a long period of time – in the USA for more than 40 years, and in the European Union for more than 25 years, for example. It is relevant for South Africa to consider critical lessons learned at the 'environment' and 'economy' interface, the most important of which involve the following:

- Integration of air quality considerations into energy, transportation, land use, housing, and other development planning processes
- Integration of economic concerns in air quality management and planning, specifically by optimizing the costs of air quality monitoring systems, systematically analyzing the costs and benefits of air quality management policies, avoiding the mandated use of particular technologies to realize emission reductions, prioritizing sources on the basis of their impacts, and using flexible measures including market instruments.

Key points to consider in integrating the needs of society with those of the environment include the potential for reducing air pollution through poverty alleviation, the importance of addressing environmental injustice through air quality management, and the need to take into account the social acceptability of air quality interventions.

Sources of atmospheric emissions

Emissions are released into the atmosphere by natural processes as well as by human processes and activities. Natural sources include biogenic releases, wind-blown dust emissions, uncontrolled veld-fires and lightning-induced formation of nitrogen oxides (NO_X).

Common anthropogenic sources of atmospheric emissions in South Africa include the following:

- *Industrial and commercial activities,* including Scheduled Processes – that is, processes identified in the Second Schedule of the Atmospheric Pollution Prevention Act (APPA) (Act no. 45 of 1965) as resulting potentially in significant atmospheric emissions – and the operations of smaller emitters such as dry-cleaners, as well as non-domestic fuel-burning equipment used by businesses, hospitals, and schools
- *Electricity generation*, specifically coal-fired and fuel-turbine power stations generating electricity for the national grid
- *Waste treatment and disposal*, including waste incineration, landfills, and wastewater treatment works
- *Residential activities,* specifically household combustion of coal, paraffin, liquid petroleum (LP) gas, dung, and wood
- *Transport,* including petrol- and diesel-driven vehicle exhaust emissions; road-dust raised by vehicles; brake- and tyre-wear fugitives and rail-, shipping-, and aviation-related emissions
- *Mining,* comprising fugitive dust releases and emissions from spontaneous combustion



- *Agriculture*, including emissions from burning crop residue, enteric fermentation, and the application of fertilizers and pesticides

- *Informal/miscellaneous,* including tyre burning and fugitive dust from construction activities and the erosion of open areas.

There is no current comprehensive national inventory for sources of atmospheric emissions. Local emissions inventories have however been developed, or are underway, in various parts of South Africa, including the Cities of Cape Town, Johannesburg, eThekwini and Tshwane, the Vaal Triangle and the Rustenburg region.

An inventory of fuel-burning related sources for the year 2002 within the electricity generation, industrial, commercial, residential, and agricultural sectors was compiled on behalf of the National Economic Development and Labour Council (NEDLAC) within the following conurbations and regions: Tshwane, Johannesburg, Ekurhuleni, Mpumalanga Highveld, Vaal Triangle, eThekwini, and Cape Town. The most significant combustion-related sources of atmospheric emissions within these conurbations were identified as follows (not ranked):

- *Industrial and commercial fuel-burning sector* – this was a significant source of particulates and SO_2 in all areas, but particularly in Cape Town, eThekwini, Vaal Triangle, Ekurhuleni, and Mpumalanga. This sector was also a contributor to NO_X emissions and to various greenhouse gas emissions (CO_2, N_2O).

- *Vehicle emissions* – in all the conurbations, these comprised a significant source of CO, NO_X, total organic compounds (TOCs), non-methane total organic compounds (NMTOC), benzene, lead, acetaldehyde, formaldehyde, and 1,3-butadiene emissions. This source also contributed approximately 30% to total fine particulate and SO_2 emissions from fuel-burning processes and was a significant source of greenhouse gas emissions (CO_2, methane [CH_4], and particularly nitrous oxide [N_2O]). Worth comment is the banning of lead additives from petrol formulations, with a resultant disappearance of lead emission from motor-vehicle exhausts[1]. Benzene is an additive to lead-free petrol formulation.

- *Domestic fuel-burning* – this significant source of low-level fine particulate and SO_2 emissions also contributed significantly to CO, TOC, and benzene emissions and to greenhouse gas emissions (CO_2, CH_4). Its contribution to fine particulate concentrations within coastal cities such as Cape Town and eThekwini was high because of the extent to which wood was burned (coal use is greater in the interior, whereas wood – which emits more fine particulate matter – tends to be burned at the coast). In inland areas, where coal-burning is more widespread, SO_2 and particulate emissions are higher from this sector.

- *Electricity generation (thermal combustion technology)* – this is a significant source of particulate, SO_2, NO_X, CO, and TOC emissions in Mpumalanga and the Vaal Triangle and, to a lesser extent, Tshwane. Despite tall-stack release of these emissions, important contributions to local ground-level concentrations are possible

Evening peak-hour traffic contributes to overnight pollution levels in Johannesburg as commuters drive along the highway.

Photography: Hot Tomato Communications

1. The "Joint Implementation Strategy for the Control of Exhaust Emissions from Road-Going Vehicles in the Republic of South Africa" was published as a General Notice in the Government Gazette in December 2003. This strategy is a cooperative governance effort of the Department of Minerals and Energy and the Department of Environmental Affairs and Tourism. It promulgated that lead, as an additive, would be completely removed from petrol in South Africa from 1 January 2006.

during unstable (turbulent) atmospheric conditions. The sector is also an important contributor of greenhouse gas emissions (CO_2, N_2O).

- *Biomass burning* (in the sense of veld-fires and crop burning) – this is a significant source of localized, episodic fine-particulate emissions. It also contributes to TOCs and greenhouse gas emissions (CH_4, N_2O).

The contribution of shipping, aircraft, and railway emissions was found to be relatively small, although it was recognized that shipping and aircraft emissions can contribute significantly to localized, ground-level emissions.

The potential impact of large-scale heavy industries with poorly controlled process-related and fugitive dust sources is greater in areas with residential settlements nearby

Significant non-combustion-related anthropogenic sources included industrial process emissions; waste disposal; dust from vehicles driving over paved and unpaved roads (vehicle-entrained dust); wind-blown dust from open areas (including mine dumps and open-cast mining); and agricultural activities. Furthermore, regionally-transported, aged aerosols contributed significantly to background air-pollutant concentrations, particularly over the interior.

An electricity transmission line.
Photography: Janet Peace

Source apportionment studies identified four major source-types, of regional significance, that are responsible for aerosol loading in the atmosphere. The four source categories include air-borne crustal material consisting of mineral soil dust; marine aerosols from adjacent oceans; particles from biomass

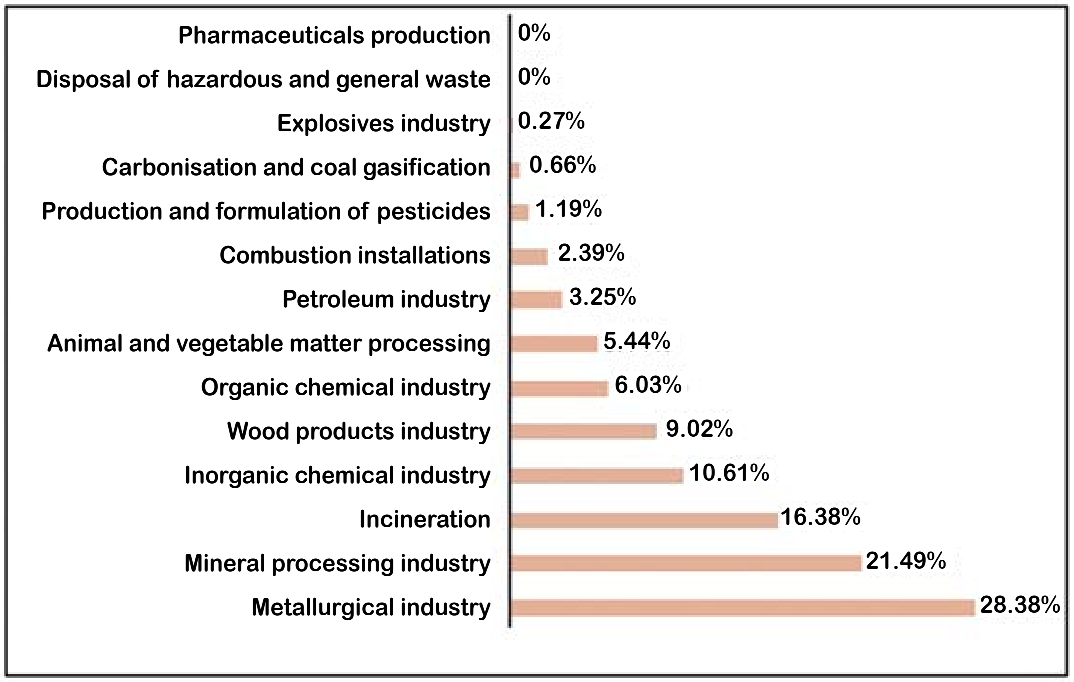

Figure A: Proportions of enterprises holding registration certificates under the Atmospheric Pollution Prevention Act, classified by broad industry type (DEAT, 2006) burning (occurring mainly north of 20° latitude south); and aerosols from industrial emissions and power generation.

Types of industries that hold Registration Certificates to operate Scheduled Processes under the APPA are indicated in Figure A. There are about 1 500 permitted, operational industries in the country. Approximately 28% of these are classified as belonging to the metallurgical industry. The mineral processing industry (21%) and incineration (16%) rank next, because of the large number of brickwork operations and medical-waste incinerators in the mineral processing and incineration classifications, respectively. There are also numerous foundries and asphalt processors in operation, as well as coal-fired power stations and sawmills.

The potential impact of large-scale heavy industries with poorly controlled process-related and fugitive dust sources is greater in areas with residential settlements nearby. Large-scale storage of chemicals in tank farms located close to residences have similarly been identified as having the potential to expose communities to unacceptable levels of volatile organic compounds, such as benzene, toluene, and ethyl benzene.

Status of ambient air quality monitoring

The status of air quality monitoring in the country was assessed by the Council for Scientific and Industrial Research (CSIR) as part of the DEAT's National Air Quality Management Programme: Phase II – Transition Project, and documented in the *Air Quality Information Review* (Output (c.1.)) (DEAT, 2006b). The air quality monitoring data were further assessed to derive trends in air pollution concentrations, and the findings are documented in the supplementary report, *Technical Compilation to Inform the State of Air Report* (DEAT, 2006a). An overview of the status of ambient air quality monitoring for the year 2004 is presented in this report, with reference made to the 2005 monitoring guidelines published by Standards South Africa (SANS 1929). The status of monitoring was evaluated according to the number of stations in operation and the integrity of the data produced.

The location of ambient air quality monitoring stations across the country in relation to population distribution is shown in Figure B. Comparison of the number of stations required in SANS 1929:2005 with those in operation revealed sufficient monitoring networks in the major metropolitan areas and industrial development zones, but little attention being paid to air quality monitoring in areas where the population was less concentrated.

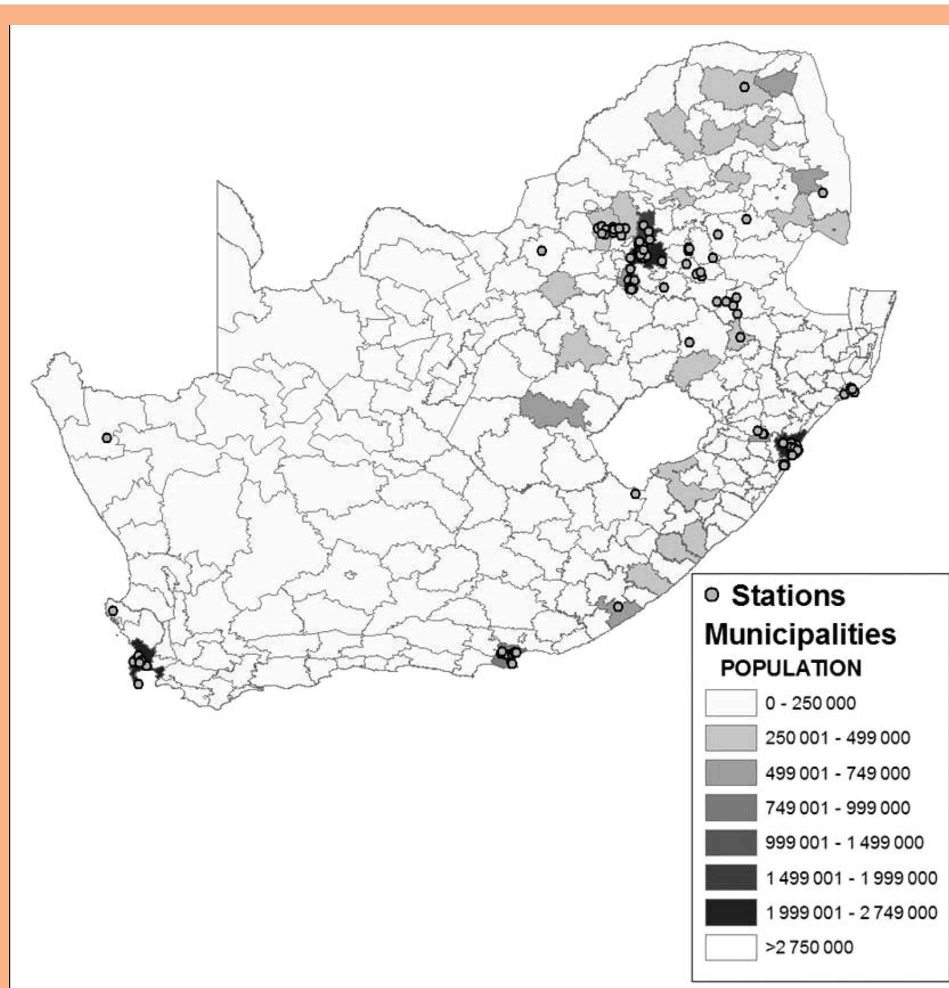

Figure B: South African population distribution by municipality, and the relative location of monitoring stations for ambient air quality. The municipal boundaries are demarcated, and the population bins used are those defined by SANS 1929:2005

Conclusions drawn from the review of air quality monitoring activities up to, and including, 2004 were as follows.[2]

- Air quality monitoring occurred mostly in industrial areas and central urban areas. Compromised air quality in dense low-income residential areas, arising from coal combustion for cooking and space heating, together with contributions from the use of unpaved roads, was either poorly

2. Since the assessment in 2004, monitoring networks have expanded in some cases, both in some of the areas indicated in the review, and into new ones.



monitored or not monitored at all. The data coverage was not sufficient to identify all potential priority areas, and was not supplemented by an emissions inventory or air dispersion modelling.

- At provincial and local government levels
  - Data coverage in all provinces other than Gauteng was inadequate for effective air quality management
  - Monitoring was generally limited to central urban and industrial areas and did not extend to rural areas. Effective air quality monitoring was conducted by a few local governments, including eThekwini, Richards Bay, the City of Cape Town, the City of Johannesburg, and the Ekurheleni Metropolitan Municipality
  - Monitoring was generally limited to a few pollutants, typically SO_2, NO_X and PM, while key urban pollutants such as ozone, $PM_{2.5}$ (that is, particulate matter with a diameter of less than 2.5 micrometres), and benzene were not widely monitored.
  - Not all local government monitoring networks had the required quality systems in place, nor were they audited by the calibration laboratories accredited by the South African National Accreditation System (SANAS).

Pollutant concentrations in Cape Town, contributing to the Brown Haze, are measured using instruments fitted to an aeroplane.

- The air pollution monitoring data at the time may have been insufficient to assess air quality impacts on human health. In particular,
  - Air quality monitoring was focused mainly on metropolitan and industrial areas, and often neglected in high-density low-income residential areas, especially rural or semi-rural ones
  - Carcinogens, such as benzene and 1,3-butadiene, that typically occur within urban environments were not commonly monitored.
- To improve understanding of background levels of air pollutants, national monitoring needed to have been expanded beyond urbanized and industrial areas. This would provide insights into ways in which pollutants are transported across boundaries.
- The data may have been insufficient to assess ecological impacts. In particular,
  - Even though ozone is a common pollutant that poses the highest risk to vegetation, most ozone monitoring was conducted in urban environments and did not extend into agricultural or natural environments
  - Wet deposition monitoring was limited to the northeastern parts of South Africa
  - Limited dry deposition work was included in research programmes, and was confined to sulphates, nitrates and ozone.

The study up to the year 2004 concluded that existing data coverage was insufficient to identify all potential priority areas accurately, or to quantify the effects of air pollution on human health and the environment.

The recommendation was to extend the spatial distribution of monitoring stations and the range of pollutants measured. Some issues would need to be addressed through a programme of monitoring, such as the monitoring of VOCs from smouldering coal-mine dumps. Furthermore, automated continuous



monitoring would need to be supplemented by other air quality monitoring and characterization techniques, with passive sampling used for spatial screening of regional pollution and for baseline characterization in small municipalities and less polluted areas. It was noted that remote sensing represents an important emerging tool for spatial screening and regional characterization, and that emissions inventories and atmospheric dispersion modelling represent critical components of cost-effective, ongoing air quality characterization. These techniques supplement monitoring by helping to predict spatial variations in air-pollutant concentrations. Dispersion modelling also allows projections to be made of changes in air quality, when new developments are considered and the implementation of emission reduction strategies planned.

Current challenges in ambient air quality

In addition to positioning itself to deal actively with emerging issues, South Africa faces the challenge of addressing a range of persistent air pollution problems. High ambient sulphur dioxide and fine particulate concentrations, arising primarily from fuel-burning within the domestic, industrial, and power-generation sectors, present persistent air pollution challenges in many areas.

Impacts on human health related to domestic coal- and wood-burning remain the most serious and pressing national air pollution problem. The location of heavy industries and communities close to each other is a continuing source of health risks and consequent conflict, exacerbated by rising pressure to position residential areas within former industrial buffer zones. Issues remain with respect to the impacts on the environment, and the transportation of pollution across boundaries, that come from elevated-stack emissions from petrochemical, metallurgical, mineral processing industries, and coal-fired power stations. Concerns have been raised about heavy metals, including mercury and chromium-VI. A consolidation of current knowledge and further research are necessary.

Emerging air pollution issues are closely associated with transport, particularly on the nation's roads. The growth in vehicle activity and the ageing of vehicles in the country are expected to offset planned and proposed measures to reduce national emissions by regulating fuel composition and through new vehicle technology. Although air quality limits for nitrogen oxide and ozone, aimed at alleviating acute effects on health, are seldom exceeded within South African cities, a notable increase in the concentrations of these pollutants is becoming apparent. Volatile organic compound releases from fuel filling-stations, and nitrogen oxide and hydrocarbon releases from major airports, have also highlighted the air quality implications of the country's transportation policies. Furthermore, the contribution of the transport sector to greenhouse gas emissions has increased significantly in the last decade (World Bank, 2006). In South Africa, transport was responsible for 27% of the final energy demand in 2000 (DME, 2005). This contribution has been increasing, particularly in urbanized populations, and, half a decade later, within the six largest metropolitan areas, transport accounted for 56% of energy consumption (SEA, 2006).

Particularly pressing challenges facing South Africa have been identified. They include (a) compliance with new, more stringent air quality standards, specifically for particulate matter; (b) understanding and addressing the risks to human health posed by exposure to air-borne hazardous materials; (c) responding to evidence that, for some pollutants, there may be no way to quantify the threshold below which exposure is no longer harmful; (d) mitigating air pollution impacts that disproportionately affect low-income communities; and (e) reducing industrial emissions without detrimental effects on society and the economy.

The challenges of climate change

Climate change is an international concern. It has given rise to the United Nations Framework Convention on Climate Change (UNFCCC), as well as the associated Kyoto Protocol that scheduled greenhouse gas emission reductions for 'developed' countries.

South Africa's estimated contribution to per capita greenhouse gas emissions is above the global average, being higher than most developing nations and equivalent to some in the developed world. National total CO_2-equivalent emissions increased by 9.4% between 1990 and 1994. This growth was primarily due to the significant increases in greenhouse gas emissions from the energy sector, whose contribution increased from 75% to 78% during this period. The three source groups

The study up to the year 2004 concluded that existing data coverage was insufficient to identify all potential priority areas accurately, or to quantify the effects of air pollution on human health and the environment

The potential impact of climate change on the health of the South African population has not been modelled, as has been done in countries such as the USA

contributing most significantly to energy-sector CO_2-equivalent emissions are: energy industries (including coal- and fuel-oil-fired electricity generation for the national grid), industry, and transport. Carbon dioxide-equivalent emissions from these three groups increased during the period 1990–1994, and transport emissions increased the most (by 38% over this period). Road transportation has been reported to contribute more than half of the transport sector's emissions.

Despite its greenhouse gas contribution, and despite having signed and ratified the Kyoto Protocol, South Africa has not been required to reduce its greenhouse gas emissions, as it is classified as a 'developing' country in terms of the convention. Its current responsibilities in terms of the convention are largely limited to reporting on the national greenhouse gas emissions on a sectoral basis, and formulating adaptation strategies.

South Africa's climate is highly variable, both temporally and spatially. Given the expectations of global warming, it is predicted that this variability will be exacerbated by an increase in the frequency and intensity of droughts and floods. This will impact upon South Africa's commercial agricultural sector and affect human settlements lying close to rivers.

Field measurements taken during research projects provide valuable insight into the state of air.

Photoraphy: DEAT

Most climate models have predicted that climate change will probably bring net drying to the western two-thirds of the subcontinent, south of about 10° latitude south. East-coast regions, where topography plays a significant role in rainfall precipitation, are expected to become wetter, although how far this wetting would extend into the interior is uncertain. The Western Cape appears to be facing a shorter rainfall season, with the province's eastern interior likely to experience increased rainfall in late summer. The country is expected to get hotter. The interior will experience the greatest increases, with temperatures predicted to rise by a maximum of 3–4 °C.

The potential impact of climate change on the health of the South African population has not been modelled, as has been done in countries such as the USA. Potential indirect local health effects are anticipated to include higher mortality rates and an increase in developmental effects, infectious diseases, and respiratory diseases due to higher ambient temperatures. Further occurrence of epidemic infectious diseases could arise from changes in the distribution of disease vectors. Indirect effects of global climate change on human welfare are also related to the potential impacts on biodiversity, ecosystems, and the availability of agricultural land and water for irrigation. There is also the prospect of overcrowding, malnutrition and starvation, allergic diseases, and suffering due to weather extremes.

Scientific advances

Considerable work and monitoring of air quality is done in South Africa through various scientific research programmes. Specific studies are normally planned to address identified research questions or hypotheses, with the purpose of adding information and contributing to a better understanding of South African air quality problems. Among the contributing research initiatives described in this report are: Cape Town Brown Haze Studies; the Southern Africa Regional Science Initiative (SAFARI 2000); regional-scale aircraft monitoring programmes; ozone modelling as part of the Cross Border Air Pollution Impact Assessment (CAPIA) project; acid deposition monitoring; biogenic volatile organic compound emission estimation; and regional-scale passive monitoring.

Developments in air quality management

The Air Quality Act of 2004 provides the framework for effective and integrated air quality management, in line with international best practice. The main aspects of this act include:

- Setting ambient air quality standards as goals for driving emission reductions
- Decentralizing air quality management responsibilities
- Requiring all significant sources to be identified, quantified, and addressed
- Recognizing source-based ('command and control') measures in addition to alternative measures, including market incentives and disincentives, voluntary programmes, and education and awareness
- Promoting cost-optimized mitigation and management measures
- Stipulating air quality management planning by authorities, and emission-reduction and management-planning by polluters
- Promoting access to air quality information and public consultation during air quality management processes.

Although the act provides for coherent, effective, and fair air quality management, its success requires a number of regulations to be set in the short term, and regulations to be reviewed and revised effectively in the medium- and long-term. Furthermore, it requires long-term resource allocation, close interdepartmental and intergovernmental cooperation, and support from business and civil society.

Progress made in the development of air quality management includes, but is not limited to, the following:

- Appointment of national, provincial, and local air quality officers and establishment of cooperative governance structures
- Publication of an air quality governance guideline series by national government
- Initiation of projects to aid the transition from air pollution regulation under the APPA to air quality management under the AQA, including: the Transitional Phase Project; the APPA Registration Certificate Review Project; the Listed Activities and Minimum Emission Standards Project; and the Air Quality Management Planning Project
- Revision of ambient air quality standards
- Conceptual design of the South African Air Quality Information System, to be hosted by the South African Weather Service
- Declaration of the Vaal Triangle as the first national priority area, and initiation of the Vaal Triangle Priority Area Air Quality Management Plan Development Project
- Improvements in the number and quality of air quality management courses offered by higher education institutions.

Further work is required in several areas, including: cost-optimization of air quality monitoring systems; integration of air quality considerations into transport, energy, and spatial development planning; emission offsetting and trading; use of multi-pollutant control strategies; applicability of various market mechanisms for realizing emission reductions; and mainstreaming air quality management and climate change strategies into local, provincial, and national planning.

Background

The Department of Environmental Affairs and Tourism (DEAT) embarked on a phased approach to the implementation of its National Air Quality Management Programme (NAQMP). Phase I, the "Definition Phase", initiated in June 2001, was completed in 2005 with the promulgation and implementation of the National Environmental Management: Air Quality Act (AQA) (Act no. 39 of 2004). In Phase II, termed the "Transition Project", the DEAT invited specialist professionals and consulting firms with project management experience and specialist expertise in the field of air quality management to submit tenders in respect of the NAQMP's implementation. In May 2004, CSIR Environmentek was appointed to assist the DEAT in implementing aspects of the programme through the Phase II Transition Project.

The Phase II project comprises several activities. The one that is specific to this report is the compilation of the state of air in South Africa for the 11-year period 1994–2004.

The 1999 National State of the Environment Report (DEAT, 1999) contained information that provided the first understanding of the state of air on a national scale. It defined 19 indicators relating to climate and atmospheric change, and mapped trends for the period up to 1995 where data were available for each of these indicators. The National State of the Environment Report, updated in 2005 (DEAT, 2005), is the major mechanism through which resource management and environmental issues were reported and analyzed on scales that transcend both local authority and provincial boundaries. The material in this report was incorporated into *South Africa Environment Outlook* (DEAT, 2006f), which reflects on the state of the environment, human vulnerability to environmental change, and future prospects.

The *State of Air for South Africa, 2005* report for the Phase II Transition Project builds on the information contained in the two national state of environment reports, and it describes the state of air in South Africa with the purpose of helping to guide the implementation of the AQA. It identifies areas where air quality is compromised or may become compromised and it highlights pollutants of concern, so as to facilitate the prioritization of resources. It also establishes a foundation for subsequent state of air reports by providing a framework for presenting air quality data. The supplementary *Technical Compilation to Inform the State of Air Report* (DEAT, 2006), reproduced in the Appendix, documents the database compiled and the analysis undertaken to support this characterization of air quality. It was also used to inform the South African Air Quality Information System (SAAQIS), whose development was initiated in July 2007.

Furthermore, the *State of Air Report 2005* and the supplementary technical supporting material (see Appendix) offer an important source of information for many Air Quality Management Plans being developed by municipalities and provinces.