

9 ATMOSPHERE

9.1 PRESSURES ON THE ATMOSPHERE

Air pollution can be defined as the emission of chemical compounds into the air resulting from anthropogenic and natural activities, which have the potential to impact negatively on the environment. Air movement is an important means of dispersing matter such as seeds, gas and dust particles. However it is also capable of transporting pollutants, thus the effects of pollution in one area may be felt in another area thousands of kilometres away. Air movement and mixing is dependent upon differences in high and low pressures and the occurrence of temperature inversions. Atmospheric constituents are removed from the air through the process of wet or dry deposition or through chemical reactions. Wet deposition is effective in removing both particulate and gaseous pollutants.

Due to the nature of activities that are undertaken within the EMM sources of pollution within this area vary considerably and include heavy manufacturing industries, a coal fired power station, mines and associated infrastructure, light industrial processes, waste sites, motor vehicles, farming and domestic fuel combustion. The EMM is surrounded by urban areas especially to its north (Tshwane) and west (Johannesburg). Beyond its immediate borders EMM is also surrounded by major industrialized areas and these include the Secunda industrial complex to the south east, the Vaal Triangle (Sasolburg, Vereeniging and Vanderbijl Park) to the south west and the cluster of metallurgical industries (Witbank, Middelburg), power generation utilities plant and coal mines on the Mpumalanga Highveld to the east. From this short description it can be seen that whilst the EMM does have significant pollution sources within its geographical area, its air quality can and is impacted by pollution sources way beyond its boundaries.

9.2 Sources of emissions within EMM

From an air pollution perspective, areas of high air pollution in SA tend to correspond with areas that have a high concentration of heavy industry. With the exception of the Germiston industrial area, heavy industrial activity is spatially spread across the EMM area in the various sub-regions in smaller clusters, comprising 1 to 3 heavy industrial sites. In addition to this, large areas of the EMM is highly urbanised with a mixed landuse i.e. industrial, commercial, mining, quarrying and residential. The transportation sector has been identified as a major source of air pollution as well.

9.2.1 Industry – Scheduled processes (including power generation)

The EMM contains some 8000 industries that occur in twenty separate industrial areas, which are concentrated in seven industrial nodes. A detailed description of the industrial sector is given in the drivers section of this report. Using the 1995 DEAT scheduled processes data base, it is estimated that there were 327 registered scheduled processes in operation within the EMM at the time. While this total might be slightly dated, it is the most accurate estimate available. It is possible that while new processes may have been added to the list some of the processes operating at the time may have closed down. An estimate of the 1995 emissions of certain priority pollutants from scheduled processes is given in Table 9.1.

Table 9.1 Estimated of emissions of priority pollutants emitted by scheduled process

Pollutant	Emissions tons per annum
Total Particulate Matter	20 417
Sulphur Dioxide (SO ₂)	48 326
Nitrogen Oxides (NO _x)	56 132
CO ₂	13 162 414
CO	567 700
Non-Methane Hydrocarbons	85 040

Source: DEAT Scheduled Processes Data Base (1995)

It is important to note that the figures presented in Table 9.1 exclude emissions other sources, such as light industry (non-scheduled processes), motor vehicles, domestic fuel combustion, mining and waste disposal sites.

9.2.2 Industry – Non Scheduled Processes, Light Industry

While individual light industries may not be considered to be major sources of air pollution on their own, their cumulative contribution to the total air pollution load could be significant. Currently there is no estimate of the contribution of the light industrial sector is to the total air pollution load. Based on the number of industries that operate in this area they could have a significant contribution to the total load. Whilst the air emissions from this sector are not expected to be noxious to their immediate environment when compared to scheduled processes, their cumulative contribution to the greenhouse gas emissions may be significant since many of these operations use fossil fuels viz. coal, oils and diesel, which generate greenhouses gases on combustion.

9.2.3 Transport

Transport and communication contributed 6% to the economy of EMM in 2001. Given the strategic location of EMM, its road, rail and air networks also support a significant amount of passing traffic. Hence air emissions from the various transportation modes that are encountered in this area are likely to be a significant air pollution source. Of the various transport modes, road (vehicle) transport is considered to be the most significant regional source of air pollution. The travel modes used for work in each of the magisterial districts within EMM is tabulated in Table 9.2.

Vehicles emit carbon monoxide, carbon dioxide, nitrogen oxides, sulphur dioxides and volatile organic carbons (VOCs). There is no quantitative information with respect to the contribution of vehicle emissions to air pollution loads in the EMM. Based on the information provided in Table 9.2 travel to work by private motor vehicles (52.5%) and mini bus taxis (27.5%) are the most popular (80%) travel modes. This is observed in the major towns and cities of SA, due to the poor state or non-existence of the public transport network in most urban areas, and a personal preference by South Africans to use their own vehicles.

Table 9.2 Travel mode used for work trips

Home district	Train %	Bus %	Taxi %	Car %	Walk/Cycle %	Other %	Total %
Alberton	4,3	5,5	40,5	40,9	7,6	1,2	100
Benoni	7,2	2,7	32,2	46,6	9,6	1,7	100
Boksburg	3,6	1,9	24,8	67,3	2,5	-	100
Germiston	0,6	0,9	3,8	84,9	7,5	2,4	100
Kempton Park	17,4	-	27,7	48,5	5,7	0,8	100
Brakpan	14,3	2,2	51,3	17,0	15,3	-	100
Nigel	2,6	-	26,9	34,4	33,6	2,5	100
Springs	2,4	9,3	24,7	45,7	17,9	-	100
All	7,2	2,6	27,5	52,5	9,2	1,1	100

Source: Ekurhuleni Integrated Transport Plan

Besides motor vehicles, emissions from the air transportation sector are also a source that needs to be considered especially with respect air quality around the JIA in Kempton Park. JIA is the largest and busiest airport in SA. The primary pollutants from aircraft are hydrocarbons (including VOCs), NO_x carbon monoxide and particulate matter. The highest emission levels tend to occur during take-off and when the aircraft are in idle mode. The Airports Company of South Africa (ACSA)(owners of JIA) has recently undertaken a study to characterise the impacts of the activities at the airport on air quality. At the time of writing this report these results were not available. However it is anticipated that these results will be available for inclusion in the next report.

9.2.4 Domestic Households

Domestic households have the potential to be one of the most important sources of air pollution. As is the case with light industry, individual households are low volume emitters of air pollutants but their cumulative impact is significant. Air pollution from domestic households is primarily as a result of the combustion of fossil fuels as an energy source. Table 9.3 gives a summary of the domestic fuel usage in the EMM.

**Table 9.3 Energy or fuel for lighting, heating and cooking for households in the EMM**

Source	Lighting (%)	Heating (%)	Cooking (%)	Average (%)
Electricity	74.84	61.73	65.63	67.4
Gas	0.21	1.62	0.97	0.93
Paraffin	3.87	13.32	25.54	14.23
Wood	N/A	1.44	0.33	0.89
Coal	N/A	19.12	6.39	12.76
Animal dung	N/A	0.14	0.22	0.18
Solar	0.15	0.15	0.23	0.27
Candles	20.72	N/A	N/A	20.72
Other	0.19	2.48	0.15	0.94

Source: Statistics South Africa: Census 2001

The use of coal and wood as a domestic source of energy is the most significant source of air pollution at a metropolitan level. In addition to this, wood and coal combustion is the primary energy source in the low income population groups as well as the numerous informal settlements that are dispersed across the EMM. This is most obvious during winter when strong inversion conditions prevail over the Highveld resulting in poor dispersion conditions i.e. the build up of air pollution levels in the first 100 to 300 m above ground level. Studies in the Vaal Triangle have shown that the contribution of domestic coal combustion can contribute 40 to 60% of the atmospheric pollution load during winter (Mintek, 1998).

9.2.5 Agriculture

Within the EMM there are large tracks of agricultural land and three main concentrations of agricultural holdings. Air emissions from agricultural activities are primarily in the form of dust emissions which peaks during late winter and early spring when the land is being prepared for sowing. This period also coincides with late winter and early spring winds which suspend dust from the bare ground. These dust emissions can at times result in the deterioration of visibility at a regional level.

9.2.6 Veld Fires

Veld fires are wide spread across the EMM, especially in the non-urbanised areas. In some cases these fires are accidental whilst in other cases the veld is burnt as part of a managed process to reduce the risk of uncontrollable fires.

Emissions from veld fires tend to produce gaseous and particulate emissions that are similar to those generated by coal and wood combustion and are seasonal in occurrence. Studies on biomass burning over Southern Africa have shown that emissions from veld fires can spread over large areas.

9.2.7 Waste Sites

A detailed description of the status, location and number of waste sites is given in Section 4.3.13.

With respect to air quality, waste sites are a source of gaseous and particulate emissions. Methane and carbon dioxide theoretically constitute 45% to 55% of landfill gas. Particulate matter is usually wind derived and associated with operational activities including waste disposal, vehicular movement, waste compacting and covering.

9.2.8 Mining

Although gold mining is the primary mining activity within the EMM other resources that are mined include coal, silver, dolomite, clay, sand and rock. Most of the mining activities occur in the Southern and Eastern SDRs. Although underground mining activities have a negligible impact on air quality, surface mining activities certainly can have a significant impact on air quality. Whilst dust is the main pollutant of concern the emission of radon gas is a concern at some of the sites

where the old mine dumps are being reclaimed. Operational, abandoned and reclaimed mine dumps are the most important dust sources related to the mining industry. Dust is usually created during windy periods, impacting on large areas. Depending on wind speeds, the footprint of the impacted areas could stretch from a few kilometres to more than 50 km from a tailings dam.

A summary of the estimated contributions of air emissions in the Southern SDR by source type compiled by EMM is tabulated in Table 9.4.

Table 9.4 Summary of estimated contributions to air emissions by source type in the Southern SDR.

Source/Activity Type	Types of Emissions	% Contribution
Industrial Activities	<ul style="list-style-type: none"> • Particulate matter (includes iron oxides, copper oxides, lead oxides and chrome oxides) • Gases (NO_x, CO₂, CO, SO₂, dioxins, formaldehydes, phenols) 	20%
Domestic fuel use incl squatter camps around Germiston Centre	<ul style="list-style-type: none"> • Particulate matter (soot) • Gases (CO₂, CO, SO₂,) 	60%
Motor Vehicle Emissions	<ul style="list-style-type: none"> • Particulate matter (soot) • CO, SO₂, NO_x 	7%
Mine Dumps	<ul style="list-style-type: none"> • Particulate matter 	9%
Veld Fires	<ul style="list-style-type: none"> • Particulate matter (soot) • Gases (CO₂, CO, SO₂,) 	3%
Other (Accidental factory fires or houses)	<ul style="list-style-type: none"> • Particulate matter • SO₂, CO, CO₂ 	1%

Source: Ekurhuleni Metropolitan Municipality (June 2003)

9.3 STATE

The most important air pollutants (e.g. SO₂, NO_x, particulate matter and greenhouse gases) result from combustion processes in the industrial, services, utilities, agricultural, transportation and domestic sectors. Currently there are no legally enforceable ambient air quality standards existing in SA.

9.3.1 Air Quality Monitoring within the EMM

9.3.1.1 Airkem

The Airkem Forum has been in existence since 1991 and is funded by industry and national government. In some cases industries undertake their own monitoring contribute data to the Forum. The Airkem Forum comprises of various stakeholders from industry, municipalities and the community with the objective of monitoring and improving air quality in the industrial and residential areas of Kempton Park, Edenvale, Germiston, Tembisa and Ivory Park. A summary of the monitoring locations for the Airkem network are given in Table 9.5

Table 9.5 Summary of monitoring locations within the Airkem network

Station Name	No. of Monitoring Points	Parameters Monitored	Comment
Kelvin Power Station	6	Dust fallout	
Esther Park	1	PM10 dust, SO ₂ , NO, NO ₂ , NO _x NH ₃	Run by Midrand Community Services and AER
Edenvale Reservoir	1	Suspended Particulate Matter	AEL runs this station
Ivory Park	1	Suspended Particulate Matter	
Tembisa	1	Suspended Particulate Matter	Tembisa Council and AER

Source: Airkem Report (October 2002)

9.3.1.2 Springs Air Quality Forum

The Springs air quality Forum was only formed during 2003 and is joint a initiative between the industry, communities and local government in the Springs area. The objectives of this Forum are to monitor air quality the area and use the information to manage air quality in the Springs area.

9.3.1.3 Smoke and SO₂ monitoring

The emission of smoke and SO₂ from industries in general prompted the need to measure ambient concentrations of these two parameters on an on-going basis in urban areas on a national basis. Over the past few years 42 local authorities have been generating data and forwarding the information to the Directorate of Air Pollution Control within DEAT or its appointed consultant. It should be noted that since the smoke and SO₂ levels are not based on direct measurements the reported levels are useful indicators of long term trends. Alberton, Bedfordview, Benoni, Boksburg, Brakpan, Germiston, Kempton Park and Springs were part of the national grid. Table 9.6 summarises the status of these sites as at 1999. With the redefining of municipal boundaries in 1999 some of these monitoring stations are no longer operational. The most recent information (June 2003) indicates that there are three smoke monitoring stations that are still active within the EMM viz. at Bedfordview Clinic, Germiston Centre and Katlehong (Goba Clinic).

Table 9.6 Summary Status of smoke and SO₂ monitoring sites

City/Town	Status of site (Smoke)	Status of site (SO ₂)
Alberton	Inactive	Inactive
Bedfordview	Inactive	Inactive
Benoni	5 Stations Active	Inactive
Brakpan	Inactive	Inactive
Boksburg	9 Stations Active	9 Stations Active
Germiston	Inactive	Inactive
Kempton Park	Inactive	Inactive

9.3.2 Status of Air Quality within the EMM: DEAT soiling index and SO₂ monitoring

Although there has been some monitoring data for the EMM there is very little information that is readily available. This section will summarise the air quality trends from the available data within the EMM.

The only meaningful long term air quality data is the data that is available from the SO₂ and smoke (soiling index) monitoring program. Long term trends for SO₂ and smoke at selected points within the EMM are presented in Figure 9.1 to Figure 9.5.

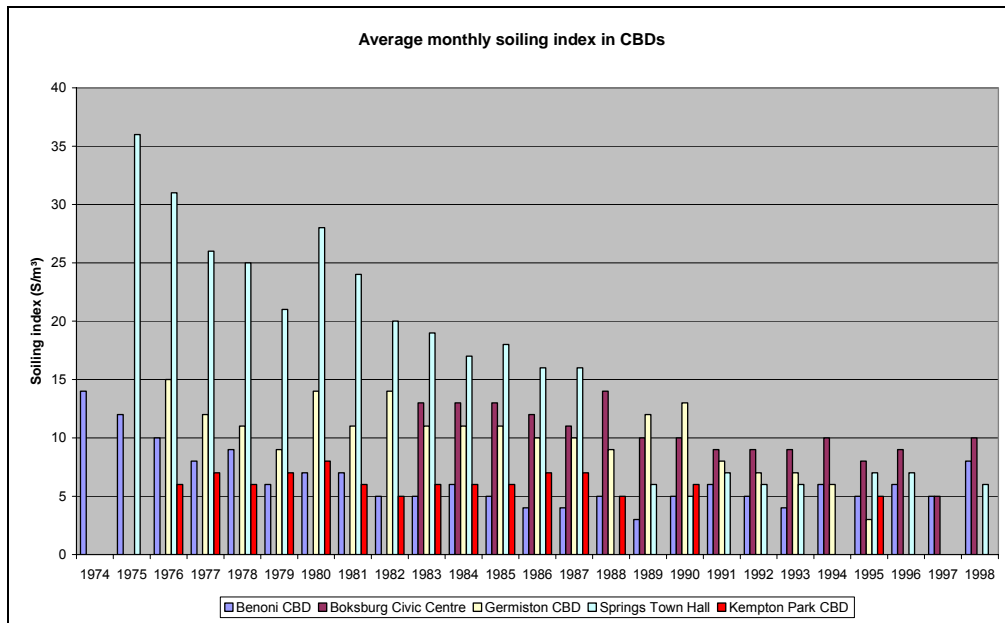


Figure 9.1: Average long term soiling index trends in CBD areas

The long term soiling index trends in the CBD areas within the EMM show an overall improvement (decrease) in most areas (Figure 9.1). This may be attributed largely to the decrease in the use of coal as a primary energy source in the period 1974 to 1998 in CBD areas as well as the change in the demographics of the CBD with fewer people using CBDs for residential purposes over the monitoring period depicted in Figure 9.1.

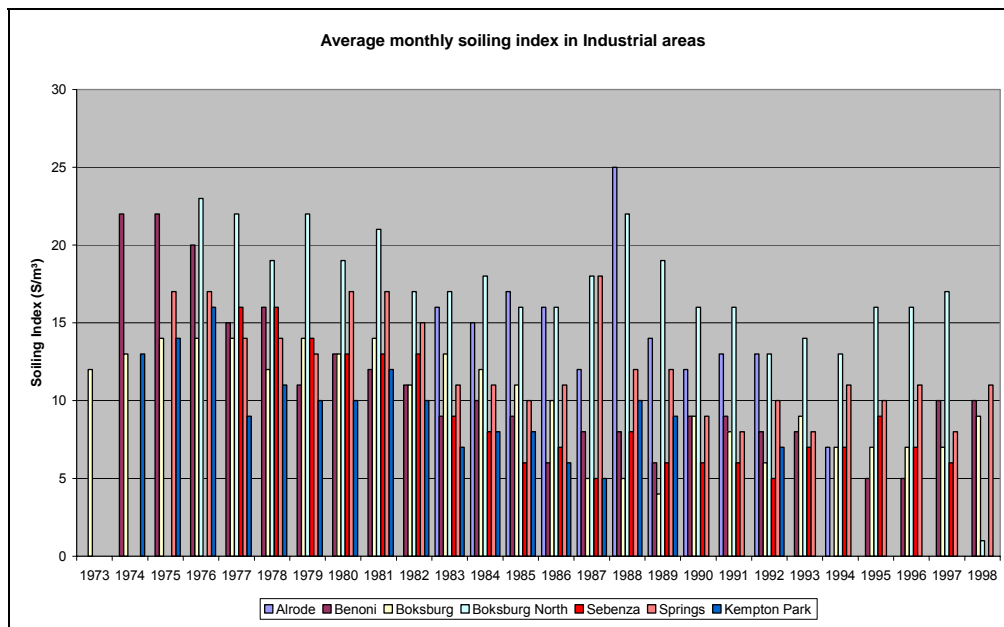


Figure 9.2: Average long term soiling index trends in industrial areas

In industrial areas the soiling index shows a bimodal trend with a decreasing trend in the period 1974 to 1986 followed by a slight increase since then at Benoni, Kempton Park and Boksburg (Figure 9.2). Soiling levels trends at Boksburg North, Springs and Alrode initially decrease in the period 1974 to 1986 followed by sharp increase during 1987 to 1988 followed by a stable trends thereafter. Reasons for these trends are unknown and possible reasons may include a decrease in the use of coal and or heavy fuel oil as a primary energy source during the initial period followed by a growth period in industrial areas with some of the new industries using coal and heavy fuel oil. Despite this possible explanation a more detailed analysis of soiling trends is required.

There is no obvious trend in soiling index levels in the residential areas other than to mention that except for Boksburg and Germiston (Delville) these levels have remained at similar levels since monitoring commenced at any of the points (Figure 9.3). The trends at Boksburg (except for 1986) and Germiston (Delville) have shown a general decrease over time. The only obvious reason for this trend may be related to an increase in the uses of electricity as a primary energy source by domestic households. However a more detailed analysis of the data i.e. actual monthly data is required.

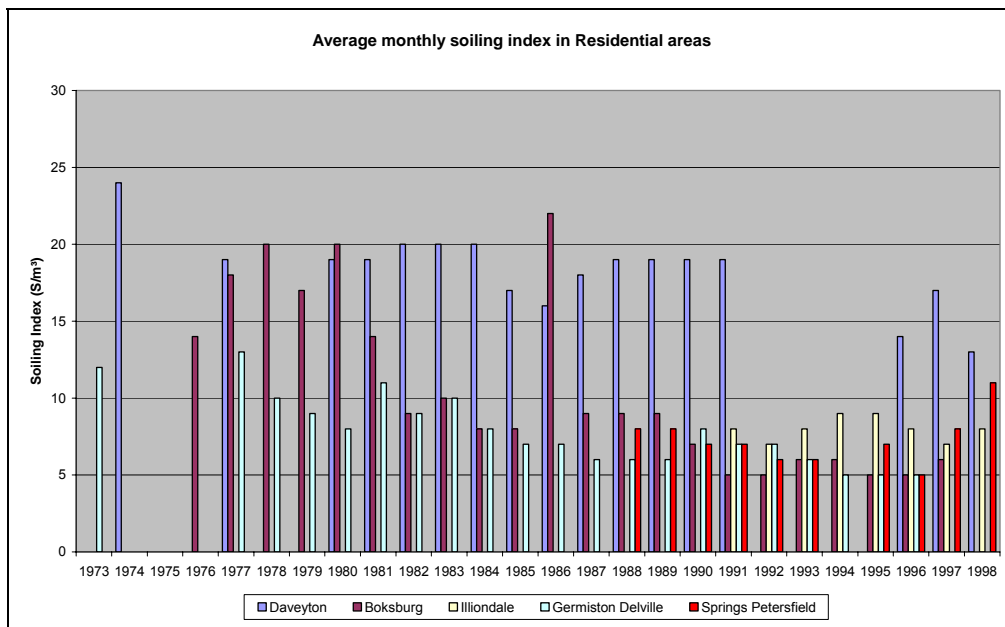


Figure 9.3: Average long term soiling index trends in residential areas

SO₂ trends in the CBD show a decreasing trend in the period 1975 to the mid-1980s followed by a spike in levels during 1986 followed and overall decreasing trend until 1996 when an increase is noted (Figure 9.4).

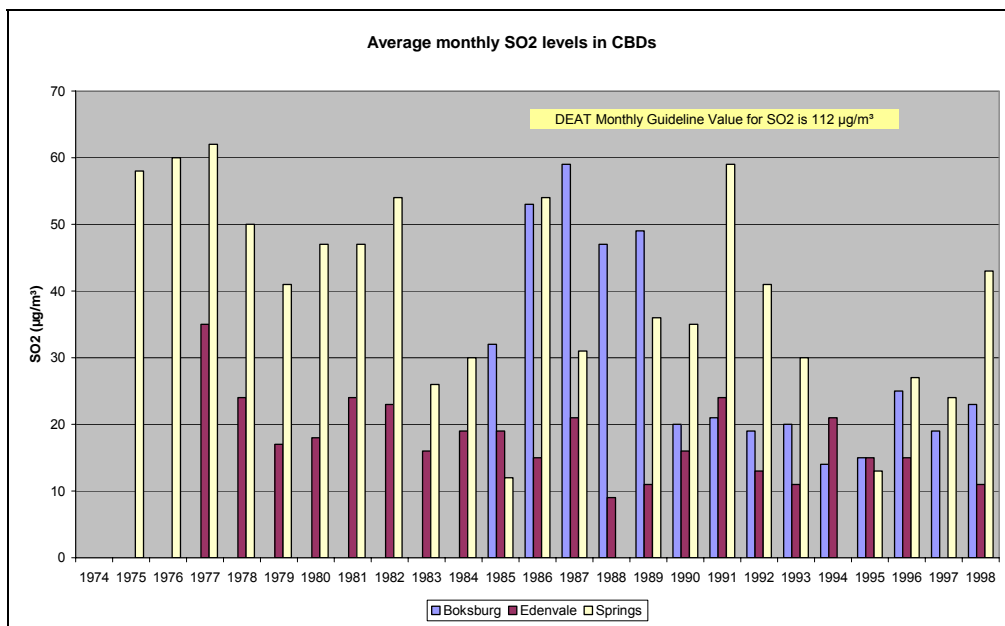


Figure 9.4: Average long term SO₂ trends in CBD areas

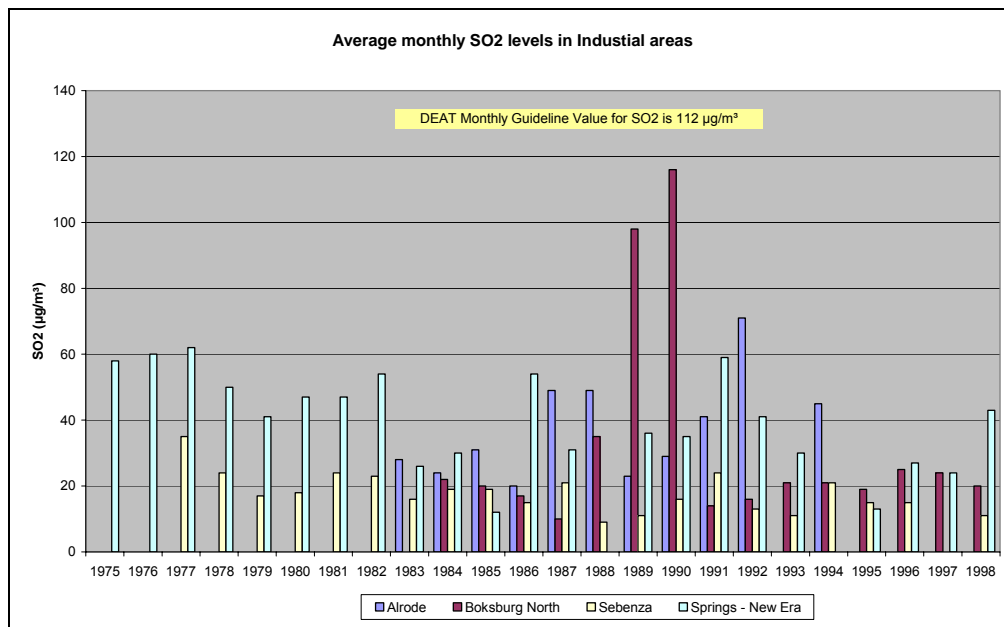


Figure 9.5: Average long term SO₂ trends in industrial areas

Except for the spikes in industrial areas at Boksburg North and Alrode during the late 1980s and early 1990s, SO₂ levels have remained relatively unchanged since monitoring commenced at the various sites (Figure 9.5). The average annual monthly SO₂ levels have not exceeded the DEAT average monthly guideline levels.

9.3.3 Status of Air Quality within the EMM: Airkem Monitoring (Source Airkem Report October 2002)

9.3.3.1 Dust fallout around Kelvin Power Station

Dust fallout around the Kelvin Power Station generally tends to be in the slight (0.25 mg/m²/day) to moderate dust (0.5 mg/m²/day) fallout categories suggesting that nuisance dust is not a significant problem in the area except on occasions when windy conditions prevail resulting in dust fallout levels of >0.5 mg/m²/day which is in the heavy dust fallout category. Dust fallout levels tend to peak towards the end of winter.

9.3.3.2 PM₁₀ levels at Esther Park

Long term trends in PM₁₀ (particulate matter < 10 µm) indicate that on an annual basis levels are relatively stable. However PM₁₀ levels do tend to peak during the period July to September as a result of the increase in township coal burning during winter and an increase in wind speeds during this period. Maximum daily mean concentrations do not exceed the DEAT daily guideline level of 180 µg/m³.

9.3.3.3 *Total suspended particulate matter at Ivory Park*

Total suspended particulate matter at Ivory Park follows a seasonal pattern of monthly concentrations $<100\mu\text{g}/\text{m}^3$ from September to March and concentrations between 100 and $400\mu\text{g}/\text{m}^3$ from April to August with peak concentrations during July. These peak concentrations are attributed to an increase in coal burning in the townships coinciding with poor dispersion conditions during winter. Long term trends since 1997 indicate that monthly total suspended particulate matter tend to be similar.

9.3.3.4 *Total suspended particulate matter at Tembisa*

Total suspended particulate matter at Tembisa follows a seasonal pattern similar to that observed at Ivory Park (See above) except that elevated concentrations persist until October and not September as is the case at Ivory Park. Long term trends since 1997 indicates that monthly total suspended particulate matter levels are stable.

9.3.3.5 *Ambient gas monitoring – Esther Park*

AEL operate an ambient monitoring station in Esther Park that monitors SO_2 , NO, NO_2 and NH_3 . This station monitors pollutants that are emitted by AEL's operations in Modderfontein. The long trends for these parameters are as follows:

- Since 1997 when ambient monitoring commenced SO_2 levels have remained stable and are similar year on year with levels peaking from May to July. Mean monthly concentrations since 1997 remain below the DEAT monthly guideline of 50 ppb.
- NO levels over the same period are also quite similar and follow a similar monthly trend with peaks during winter but remaining below the DEAT monthly guideline of 200 ppb. The highest average concentration reported was did not exceed 50ppb.
- NO_2 levels follow a similar pattern to those observed for NO. However during 2001/2002, NO_2 levels exceeded historical levels during the October to March period buy nearly double the magnitude of preceding years but remained below the DEAT monthly guideline level of 80 ppb. NO_2 levels exceeded the monthly guideline level August and September 1999.
- During 2001 and 2002 NH_3 levels tend to be below 50 ppb. However there have been exceptions with levels greater than 50 ppb recorded during early and mid 1999 and once again in 2001 and mid 2002. AEL have closed down their ammonia plant and ambient NH_3 levels are expected to decrease as a result.

9.3.3.6 *Air pollution hotspots*

A qualitative indication of the potential zones of air pollution is given in Figure 9.6. This map gives an indication of the air quality hotspots that will require special attention in the short to medium term.

Figure 9.6: Potential zones of air pollution and proposed monitoring stations

9.4 IMPACTS

Air pollution may result in disturbances to ecosystems, climatic conditions, biogeochemical cycles and human health.

Motor vehicles are generators of carbon monoxide and carbon dioxide which contribute to the global greenhouse gas budget which results in global warming. Nitrogen oxides (NO_x) which are emitted by motor vehicles are precursors to ground level ozone which can trigger serious respiratory problems. Other pollutants from motor vehicles include SO₂ a primary contributor to acid rain and volatile organic compounds (VOCs) some of which are known carcinogens. VOCs are also precursors to ground level ozone.

Domestic coal and wood combustion generates both gaseous and particulate pollutants. The more important gaseous pollutants include SO₂ and VOCs which pose ecological and health risks to the floral and faunal environment. Particulate matter especially those in the respirable size range (<10µm) poses both a health risk to human receptors and degrades the visibility of an area.

While airborne emissions from veld fires tend to impact on visibility at a localised scale, their contribution to the degradation of the regional scale air quality can be significant as well.

The components of the landfill gas most likely to cause a health risk theoretically constitute 2% of the total volume of landfill gas emission consisting of VOCs that include acetone, benzene, methylbenzene, dichloropropane, tetrachloroethylene, xylene, toluene, ethylbenzene and inorganic gases such as hydrogen sulphide (source of odours), hydrogen cyanide, ammonia and chlorine (Saner, 2003) being the most prominent emissions. In most cases the most severe impacts from landfill gas emissions are limited to areas within 3 km of the waste site and include nuisance (odours and dust), health (exposure to VOCs and other gases) and ecological (degradation of vegetation in close proximity to the waste sites) impacts on receptors. Given that the majority of air emissions from waste sites are largely composed of methane and carbon dioxide which are greenhouse gases, waste sites certainly do have an impact on the global greenhouse gas budget. Hence whilst these types of emissions are not necessarily observed by the public (visually and olfactory) they do impact on the global atmosphere.



Dust emissions from mine dumps can have adverse impacts on human health, property and the ecological environment because they contain chemicals such as mercury, cyanide, sulphur compounds and other heavy metals that are toxic to receptors. Besides this most the majority of the mine dumps consists of silica bearing mineral α -quartz which can cause silicosis in human beings. The presence of sulphur bearing minerals in the dust can increase that acidity of the soil in the areas over which they are deposited resulting in

the acidification of soils thus reducing soil quality. To date there is no information quantifying air emissions from the mining industry and more specifically mine dumps within the EMM.

Climate change is caused by the increase in the atmospheric concentration of greenhouse gases (GHGs), most importantly carbon dioxide (CO₂) and methane (CH₄). The build up of GHGs is changing the ability of the atmosphere to absorb and retain energy. This is a natural phenomenon, which is being enhanced by the contribution of human or anthropogenic activities. In order to reduce or mitigate the impacts of climate change a number of programmes are currently underway globally and locally.

9.5 RESPONSES

9.5.1 Policy

A policy for air quality management in the EMM needs to be developed. The policy needs to focus on management of air quality issues that are specific to the EMM. It should be noted that whilst the responsibility of air quality management is almost entirely a national government function the proposed Air Quality Bill will increase the responsibility of local government with respect to air quality management. In future local government will be responsible for passing, implementing and policing air quality legislation within the framework that will be developed by national and provincial government. Besides specific legislation the constitution of SA which is the supreme law of the country entitles the citizens of the land certain rights that are included in the Bill of Rights in Section 7 of the constitution. The state must respect, promote, protect and fulfil the rights in the Bill Rights.

With respect to the environment, Section 24 of the constitution states everyone has the right to:

- to an environment that is not harmful to their health or well-being; and
- to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that
 - prevent pollution and ecological degradation;
 - promote conservation; and
 - secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

The EMM currently does not have a policy for air quality and air quality management. Given the proposed changes in legislation and the rights enshrined in the constitution, the EMM will be expected to undertake a more active role in air quality management. Hence a policy on air quality management has to be formulated as a basis for air quality management in the municipality. Whilst the policy needs to be consistent with national legislation and preserve the rights enshrined in the constitution, it needs to reflect issues that address the needs and aspirations of the EMM at a local level. The policy will have to amongst others consider the following:

- Provincial legislation;
- Geographic location of the EMM;
- Existing air quality in the EMM;
- Landuse and related air pollution generating activities;
- Population density and

- Climate of the area.

9.5.2 Legislation

9.5.2.1 South African Legislation

Air quality management in SA is currently governed by the Atmospheric Pollution Prevention Act No. 45 of 1965 (APPA Act) which is in the process of being replaced the NEMA: Air Quality Bill of September 2003 (AQ Bill). Under the APPA Act, air quality management was largely a national government function which primarily focused on industrial air quality management and emissions control rather than management of air quality within an air shed or air basin. Local government did not have any jurisdiction over any process that was included in the list of Scheduled Processes. In the AQ Bill the responsibility of air quality management is entrusted to local government with national and provincial government setting the policy and the framework for air quality management.

Under the APPA Act certain of the municipalities that are now part of EMM had passed by-laws that controlled the emission of smoke (i.e. control sources of smoke) and declared areas within its jurisdiction or parts thereof to be smoke control zone/s. The responsibility of implementing these by-laws was a local government function. In most if not all of cases the health department were responsible for policing these by-laws.

With the AQ Bill in the process of being implemented air quality legislation at local government is in an indeterminate state. In some cases local governments have adopted the by-laws that they have inherited. However the AQ Bill will require the replacement of existing by-laws with the new ones.

9.5.2.2 International conventions, treaties and agreements

Air quality and climate change is not limited to a local level, and SA is party to various international conventions, treaties and agreement (Table 9.7). The AQ Bill empowers the Minister to ensure that SA abides to any international agreement that is binding on the country.

Table 9.7 Summary of important international agreements relating to air quality management

Agreement name	Year of Agreement	Purpose	Status
Montreal Protocol in substances that deplete the Ozone Layer	1987	A protocol that controls the use of ozone depleting substances and the import of such chemicals.	SA acceded to this Protocol in 1990 obliging SA to abide by the requirements of this protocol
United Nations Framework Convention of Climate Change (UNFCCC)	1992	Global agreement to reduce greenhouse gas emissions	Ratified by SA in 1997. Since SA is a developing country it is not obliged to limit its greenhouse gas emissions. However this could change.
Kyoto Protocol	1997	Protocol for the reduction and control of greenhouse	Ratified by SA in 2002. SA acceded to this protocol in July

		gas emissions as per the UNFCCC.	2002. The protocol has not been ratified by the required number of signatories and is therefore not enforceable. This could change in the near future.
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9.5.3 Programmes and initiatives

Air quality management is currently at an early stage of implementation in the EMM and hence there very little being done in terms of long term air quality management at this point in time. It was also significant to note that many of the public sector programs and initiatives that existed in the individual council have to a large extent either been terminated or being undertaken on an ad-hoc basis. Currently the health department handles daily air quality complaints. The main reason for this is that the EMM is in a transition phase of restructuring its various departments and their respective responsibilities.

Air quality management will be the responsibility of the Environment and Tourism Department. Within the EMM there is currently no uniform air quality monitoring strategy (AQMS) in place in the private and public sector. The monitoring networks that are in place have been set up to address local concerns and were governed by the budgets allocated for air monitoring by the old councils and requirements of national smoke and sulphur dioxide monitoring program that was run by the National Chief Air Pollution Control Officer. However, with the formation of the new metropolitan municipality and changes in air quality management priorities at national government level, many of the monitoring activities have either been stopped or down-graded during the past 10 years. This situation is unlikely to continue since the EMM is in the process of developing an air quality management strategy for the municipality. This process also coincides with changes in air quality management legislation at national level. The development of the air quality management strategy will be conducted in the short term and thereafter implement this strategy in the medium to long term. The initial tasks will require the assessment of the current status of air quality management in the EMM followed by the development and implementation of an air quality management framework. The development and promulgation of by-laws, identification and planning of monitoring requirements, identification of air pollution hotspots, development of monitoring systems and assignment of roles and responsibilities are considered to be the most important aspects. The ultimate objectives of any air quality management strategy should be to improve existing air quality, reduce air emissions and reduce health and ecological impacts.

One the objectives of the strategy would be to develop and implement an air quality monitoring plan for the municipality. The plan will attempt to implement a monitoring network that will rationalise and update existing monitoring activities within the municipality to meet data requirements of the municipality that will enable it to manage air quality. The AQMS will be developed such that it also meets if not exceed the requirements of The National Environmental Management Act: Air Quality Bill that is expected to be promulgated during the September 2003 parliamentary session.

The Gauteng Department of Agriculture, Conservation, Environment and Land will be establishing two air quality monitoring stations in conjunction with EMM in Leondale (Wadeville area) and

Springs as part of its air quality monitoring network. The positions of these are depicted in Figure 9.6. Although the parameters to be monitored have not been finalised they are likely to include the priority pollutants that include particulate matter (PM10, PM2.5) SO₂ and NO_x.

9.6 MONITORING

9.6.1 Information and data gaps

9.6.1.1 Information Sources

An assessment of the available information indicates that except for the smoke and SO₂ monitoring data that was undertaken in the past as part of a national monitoring program there is very little long term data to assess trends and general air quality. Whilst the data generated by the Airkem project presents more recent air quality trends, it is limited by the fact that it monitors air quality in a small section of the EMM and the parameters that are monitored. Other attempts to monitor air quality in the EMM have either been short lived or disjointed and hence any data collected tend to be very specific to the purposes for which it was collected. In addition to this any available ambient air quality information be it private or publicly owned information is not easily accessible.

9.6.1.2 Information Gaps

There are a significant number of gaps with respect to air quality data in the EMM and this includes both emissions (source) and ambient data.

With respect to source data there is a need for the establishment of a comprehensive emissions inventory from all potential sources of air emissions within the EMM for certain priority pollutants. This will be a licensing requirement for 'Listed Activities' (currently termed Scheduled Processes) which will be a local government responsibility when the Air Quality Bill is promulgated. SA has ratified and acceded to the Kyoto Protocol in 2002. Although SA is not obliged to reduce greenhouse gas emissions during the initial period (2008 to 2012), this could change after 2012 especially when the protocol is implemented. Important commitments include quantification and reduction of greenhouse gas emissions that are emitted within SA. The collation of this information will almost certainly require local government input either in the form of promulgation of legislation or collation of information that has been supplied by generators of air pollution that fall within its jurisdiction.

With respect to ambient air quality data a comprehensive ambient air quality monitoring plan needs to be developed and implemented. This will include consolidation of existing public and private air quality monitoring programs. The development of an ambient air quality monitoring program will assist the EMM in prioritising air monitoring programs with a view to addressing the air pollution hotspot areas first and progressively expanding the network to other areas.

All emissions and ambient air quality information must be forwarded to and collated at a centralised point in a GIS based system that will allow for easy access to information to the various stakeholders in the EMM including local government, the public and business sectors.

9.6.2 Recommended future indicators

A table of monitoring requirements and indicators for climate change and air quality is summarised in Table 9.8

Table 9.8 Summary of monitoring requirements and indicators for climate change and air quality monitoring

Indicator	Comment
Energy Use	An inventory energy usage needs to be compiled with details on fuel type used, location of user and generator
Greenhouse gas (GHG) emissions	GHG gas (CO ₂ , CO, CH ₄) emissions need to be quantified so that the EMM is ready for implementation of the Kyoto Protocol i.e. GHG reduction and take advantage of any opportunities to accumulate and trade carbon credits
Meteorological Monitoring	This is already being done by the South African Weather Service at JIA. Parameters include wind speed, wind direction, precipitation, sunshine days and temperature.
Air pollution source emissions inventory	A programme to identify & quantify air emission sources in the EMM is required. This will allow the EMM to identify and manage pollution hotspots more effectively.
Ambient air monitoring	Ambient air monitoring stations must be established at strategic locations across the EMM to monitor for priority pollutants viz NO _x , SO ₂ , smoke, ozone, particulate matter (PM ₁₀ & PM _{2.5}).
Priority Areas	Priority air quality management areas need to be identified and specific air quality management plans need to developed for these areas.
Legislation	Once the AQ Bill has been promulgated, the EMM will need to develop and promulgate by-laws that will allow them to fulfil their obligations under the Act

9.7 CONCLUSIONS

Based on the findings of this initial assessment the following are concluded:

- Air quality is considered to be an issue from an aesthetic, ecological and health perspective in the EMM;
- Depending on whom one is speaking to there is a perception that the air quality in the EMM is very poor, especially during winter, however there is no satisfactory data to prove or disprove these perceptions;
- Generally the generators of air emissions are not in a position to provide information on their emissions i.e. what and how much;
- The existing programs that monitor air quality in the EMM are limited to localised issues and this has resulted in information gaps regarding the state of ambient air quality in the EMM;
- An emissions inventory and ambient air quality monitoring strategy need to be developed and implemented;
- The EMM needs to urgently provide resources to air quality management as well as to define their roles and responsibilities, since many of the air quality management issues are currently being handled on an ad hoc basis and air quality management is being undertaken in a vacuum;

- A challenge for the future would be the development of by-laws and complying with the obligations of the AQ Bill, which devolves the responsibility of implementing air quality management to local government;
- A qualitative indication of potential zones of air pollution is present in Figure 9.6. This map gives an indication of air quality hotspots that will require special attention in the short to medium term.

9.8 REFERENCES

- Airkem (2002). Report on Air Quality Measurements during the period October 2001 to September 2002, Konditek Report KDK/AKM AQM VG 007, October 2002.
- Airshed Management Services (2003). Wind Rose for Johannesburg International Airport.
- C&M Consulting Engineers cc, (1999). Statistics on Smoke and Sulphur Dioxide Pollution in South Africa, April 1999.
- DEAT (1995). Scheduled Process database.
- EMM (2003). Fax received from Germiston Service Delivery Centre regarding Atmosphere, Climate, Noise and Water Quality Data, dated 26 June 2003.
- EMM (2002/2003). Solid Waste Annual Report 2002/2003.
- Margot Saner and Associates (2003). Assessment of the Composition of Landfill Gas at the Closed Ibhayi Waste Disposal site, May 2003.
- Mintek, (1998). Special Publication No. 17, Aerosol Monitoring and Source Apportionment in the Vaal Triangle, May 1998.
- South African Weather Services (1992).WB 42. 1992
- Tyson PD and Preston-Whyte RA, (1998). The Weather and Climate of Southern Africa, 2nd Edition.