AIR QUALITY MANAGEMENT PLAN FOR THE EMM

Item B-ET (3a-2005) **MC 21/04/2005**	**REPORT TO COUNCIL FOR THE APPROVAL AND ADOPTION OF THE AIR QUALITY MANAGEMENT PLAN FOR THE EKURHULENI METROPOLITAN MUNICIPALITY**

RESOLVED:

1. **That** the report regarding the development of the EMM: Air Quality Management Plan **BE NOTED**.

2. **That** the Air Quality Management Plan for Ekurhuleni Metropolitan Municipality and Air Quality Baseline Report **BE APPROVED**.

3. **That** it **BE NOTED** that the Air Quality Management Plan **WILL BE REVIEWED** in 2007.

4. **That** Councillors A M Zwane and J O'Reilly **BE NOMINATED** to serve in the Air Quality Management Plan Task Team.

FINAL REPORT

AIR QUALITY MANAGEMENT PLAN FOR THE EKURHULENI METROPOLITAN MUNICIPALITY

Air Quality Management Plan compiled on behalf of and in consultation with in the Department of Environment & Tourism, Ekurhuleni Metropolitan Municipality

Report No.: APP/04/EMM-02c

DATE: 25 January 2005

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Ekurhuleni
METROPOLITAN MUNICIPALITY

EXECUTIVE SUMMARY

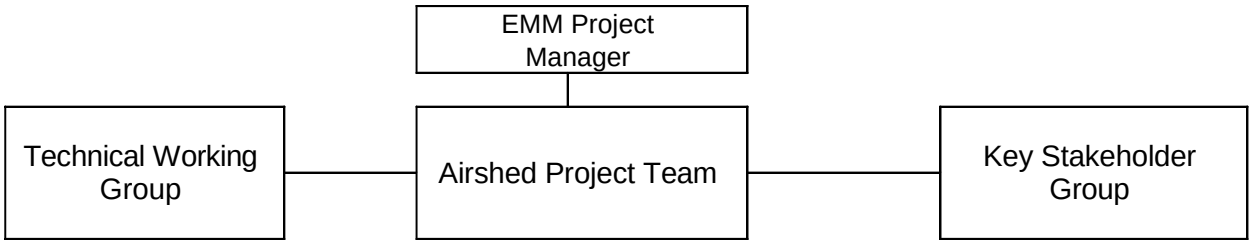
1. BACKGROUND

Ekurhuleni Metropolitan Municipality (EMM) Environment and Tourism Department has Undertaken an air quality management plan development project. Airshed Planning Professionals (Pty) Ltd was appointed to assist the metropolitan municipality in this regard. Airshed sub-contracted Environmental Science Associates and Zitholele Consulting to provide support services for the project. Zitholele is responsible for public notification of the project and for consultation with interested and affected parties. The project had two focus Areas:

- Baseline Assessment of air pollution concentrations and air quality management practices within EMM, and inventory of national and provincial requirements pertaining to AQM Plan development.
- Development of an Air Quality Management Plan for EMM, taking into account:
    - Operational and functional structure requirements
    - Air quality management system component requirements
    - Source identification and prioritization
    - Mechanisms for facilitating inter-departmental co-operation in the identification and implementation of emission reduction measures for certain sources
    - Human resource development (training) requirements

2. SUPPORT STRUCTURE ESTABLISHMENT

Given the importance of the product it was considered imperative that the project team not function in isolation from the EMM and key stakeholders. The following structures were therefore established:



The Technical Advisory Group was comprised of persons able to contribute to the process in one of two ways: (a) through providing input into the air quality management system design, e.g. participating in the design of the air quality monitoring network; and (b) assisting with emission reduction measure drafting and with assessing the feasibility and cost implications of implementing measures within the industrial, mining, domestic fuel usage and transport sectors. Representatives from the various EMM departments responsible for environmental management, environmental health, municipal infrastructure, housing, transport and spatial planning have been invited to participate on the technical working group. Representation was also invited from Airkem and the Springs Air Quality Forum due to the existing or proposed air quality monitoring activities of these groups. The Gauteng Department of Agriculture, Conservation, Environment and Land Affairs (GDACE), the Department of Environmental Affairs and Tourism (DEAT) and the Department of Minerals and Energy (DME) were also asked to nominate representatives.

Key stakeholder group representatives were identified by Zitholele Consulting on the basis of a consultative process. The main functions of the Key Stakeholder Group included:(i)assisting in the categorisation of issues raised during broad consultation process; (ii) assisting in

identifying the potential for trade-offs and compromises where conflicting views are given by various stakeholders; and (iii) acting as a "sounding board" to assist the project team in determining whether the key issues have effectively been communicated in the documents scheduled for distribution.

3. KEY FINDINGS FROM THE BASELINE ASSESSMENT

3.1 Priority Pollutants

Pollutants that have been measured to exceed guideline values within the EMM include PM10 (Particulate matter less than 10 microns in aerodynamic diameter), sulphur dioxide and Nitrogen dioxide. Sites at which such exceedances have been *measured* [1] *to* occur are as Follows:

Nitrogen dioxide	Esterpark
Particulates	Esterpark, Boksburg, (various sites – Etwatwa, Boksburg, East, Reigerpark, Vosloorus, Villa Liza), Brakpan, Springs (various sites – CBD, New Era, Nufiels, Thebelisha, White City), Tembisa and Ivory Park
Sulphur dioxide	Esterpark, Boksburg (Cinderella, Boksburg East, Vosloorus), Brakpan (Leachville), Springs (various sites – CBD, New Era, Nufield, Thebelisha, White City, Dr WK du Plassis School), Tembisa and Ivory Park

Based on monitoring campaigns conducted within Ekurhuleni and in similar local urban areas, benzene and ozone have been noted to exceed health guidelines. Benzene thresholds are typically exceeded in close proximity to busy highways and intersection and at large filling stations. Ozone, which is formed in the atmosphere through the conversion of volatile organic compounds and oxides of nitrogen, is typically elevated downwind of urban areas.

3.2 Priority Sources

Sources that have been found to be significant in terms of their contributions to ambient Air pollutant concentrations and associated health risks include:

- Household fuel burning - particularly coal and, to a lesser extent, wood burning, household fuel burning is predicted to be a very significant contributor to fine particulate concentrations within densely populated areas.
- Industrial and commercial fuel burning - particularly uncontrolled coal-fired boilers in close proximity to residential areas. These sources contribute significantly to ambient sulphur dioxide and PM10 concentrations.
- Vehicle exhaust emissions - including both petrol and diesel vehicle emissions. Road traffic is the most significant source of NO_X, CO and VOC emissions and is anticipated to contribute significantly to ozone formation. (NO_X and VOCs are both important precursors of photochemical products.)
- Johannesburg International Airport - despite contributing only a small fraction of the total emissions, the airport is a significant source of low level, concentrated NO_X emissions. The airport is anticipated to contribute to NO_2 guideline exceedances in the vicinity of the airport.
- Unrehabilitated mine tailings impoundments - significant source of nuisance dust fall and potentially contribute significantly to airborne concentrations of fine particulates
- Large industries associated with various stack, vent and fugitive emissions. These Industries were not adequately quantified during the baseline assessment due to the unavailability of current and comprehensive source and emissions data for such operations.

3.3 Priority Areas

Priority areas that may be subjected to elevated levels of air pollutants include:

[1] Only sites at which exceedances were monitored to have been exceeded are listed in the table. It is noted that guideline] exceedances is likely do occur at various other locations within the EMM at which monitoring has not been conducted

- Household fuel burning areas - due to high particulate concentrations associated with fuel burning for cooking and heating purposes;
- Central |business district and residential areas transected by highways, on-ramps and main feeder roads;
- Residential areas in close proximity to industrial areas such as Olifantsfontein, Clayville,Isando,Wadeville,Alrode, Benoni South and Apex industrial areas, Springs industrial areas such as Nuffield and New Era;
- Residential areas in close proximity to Johannesburg International Airport; and
- Residential areas near uncontrolled mine tailings impoundments.

3.4 Summary of Priority Pollutants, Sources and Areas

A synopsis of pollutants, contributing sources and key impacts areas is presented in the table below.

Pollutants	Main Contributing Sources	**Key Impacted Areas**
PM10, PM2.5	- Household fuel combustion (notable given high exposures) - Transport (primarily diesel vehicle emissions) - Industrial (including process emissions, fugitive dust and fuel combustion products) - Vehicle entrapment from unpaved roads - Other sources (primarily wild fires, agricultural activities, tyre burning - significant in terms of episodes)	Elevated concentrations over much of the EMM resulting in widespread health risks, with significant health effects anticipated in residential fuel burning areas (e.g. Tembisa, Etwatwa).
NO_2	- Transport (petrol vehicles, diesel vehicles then airport activities) - Industrial processes - Household fuel combustion - Wild fires, tyre burning, etc. as minor sources	Notably elevated concentrations (health threshold exceedances) in close proximity to busy roadways
Ozone	- Secondary pollutant associated with NO_X and volatile organic compound releases - Transport (petrol vehicles as key contributor, also diesel vehicles, airport activities) - Household fuel combustion - Industrial processes - Wildfires	Anticipated to be elevated across the metro, particularly downwind of major sources of precursor pollutants (i.e. NO_X and volatile organic compounds). Monitoring is required to confirm ozone levels.
$S0_2$	- Industrial and non-domestic fuel burning sector (particularly due to coal and to a much lesser extent HFO combustion) - Transport (diesel vehicles, petrol vehicles) - Household fuel combustion - Tyre burning, wild fires	Large spatial variations in concentrations anticipated. Guideline exceedances noted in close proximity to heavy industrial areas. Monitoring within household coal burning areas required to determine potential for health threshold exceedances.

4. PROPOSED AIR QUALITY MANAGEMENT PLAN

4.1 Policy Framework

The EMM's vision, mission, overarching principles and general approach to air quality management should reflect the vision, principles and approach adopted in terms of national and provincial policy in addition to local goals.

*4.1.1 **Vision***

Attainment and maintenance of acceptable air quality for the benefit of present and future generations.

*4.1.2 **Mission and Commitment:***

To lead the protection and enhancement of the Metro's air quality through proactive and effective air quality management and sustainable development of the built environment and transportation systems within the Metro.
To work in partnership with the community and stakeholders to ensure the air is healthy to breathe and does not impact significantly on the well-being of persons.
To reduce the potential for ecosystem damage from air pollution and to address global air quality problems.

As a result of the EMM's activities improvements in air quality are envisaged despite countervailing trends in population, development, and transportation growth. In achieving such improvements, the EMM is committed to:

- Establishing a set of shared goals and strategies for air quality improvement.
- Establishment and continued implementation of a comprehensive air quality monitoring and management system.
- Involving and educating the public with the purpose of minimizing pollution and facilitating the effective participation of the public in air quality governance.
- Integrating air quality considerations into housing, transportation and spatial planning developments.
- Making greater use of innovative approaches to reducing pollution.
- Conducting sound research and effectively use new information technologies.
- Respond creatively and vigorously to new challenges and emerging issues.
- Improve the Working partnership of personnel responsible for air quality management at all levels of government.
- Facilitate effective inter-departmental and inter-governmental cooperation for the purpose of accurate! Source quantification and identifying and implementing effective emission reduction measures.

4.1.3 Strategic Goals and Objectives

The main goals to be achieved by the EMM through its development, implementation, review and revision of air quality management plans are as follows:

- To achieve and sustain acceptable air quality levels throughout Ekurhuleni.
- To minimize the negative impacts of air pollution on health, well-being and the environment.
- To promote the reduction of greenhouse gases so as to support the council's climate change protection programmer.
- To reduce the extent of ozone depleting substances in line with national and international requirements.

Specific objectives include:
-To promote cleaner production and continuous improvement in best practice as it pertains to air pollution prevention and minimization.
-To promote energy efficiency within all sectors including industrial, commercial, institutional, mining, transportation and domestic energy use.

4.1.4 Approach to Air Quality Management

A shift from end-of-pipe air pollution control through the exclusive implementation of command-and control measures to effects-based air quality management using proactive, flexible, varied and fair measures is supported by the new policy. The key approaches that are to be implemented in order to achieve policy objectives may be individually listed as follows:

- Adoption of a receiving environment approach which requires the *setting of local* air quality objectives
  Such objectives are needed to define what constitutes satisfactory air quality to ensure! Human health and welfare, the protection of the natural and build environment, and finally the prevention of significant decline.
- Establishment of a *sound technical basis* for air quality management and planning.
  This would include the building of technical expertise and the development and implementation of various tools such as an emissions inventory, a meteorological and air pollution monitoring network, atmospheric dispersion model, impact assessment methodologies (etc.).
- Control and management of all significant sources of air pollution relative to their contributions to ambient air pollutant concentrations.
  This will ensure that improvements in air quality are secured in the most timely, even-handed and cost-effective manner.
- Implementation of a range of tools in the prevention of air pollution including: source-based command-and-control measures, market incentives and disincentives, voluntary initiatives and self-regulation and education and awareness methods.
  The integration of a wide range of emission reduction measures is required given the diversity in the nature of air pollution sources. Such an approach will ensure innovative and flexible plans of action tailored to suit specific source types and local circumstances.
- Identification and implementation of emission reduction measures that are: (i) environmentally beneficial taking all media into account, (ii) technically feasible, (Hi) economically viable, and (iv) socially and politically acceptable.
- Provision will be made for the integration of air quality issues *into the* transportation, housing and land use planning process to ensure that air quality issues are addressed in the long term.
- Empowerment of communities by providing easy access to ambient air quality information, including information on air pollution concentrations and environmentally harmful practices.
- Facilitation of public consultation and encouragement of public participation in the air quality management and planning process.

4.2 Air Quality Management System

An air quality management plan cannot be successfully implemented and revised in the absence of an effective air quality management system. The EMM AQMP must therefore have as a key focus the establishment of such a system in the short term (next two years).
Air quality guidelines represent an important air quality management 'tools'. Such guidelines need to comprise, as a minimum, guideline or limit values and permissible timeframes for bringing; air quality into compliance with such values. Other essential tools in any air quality management system are: emissions inventory, air quality and meteorological monitoring and atmospheric dispersion modelling (Figure 1).

On the basis of a comprehensive emissions inventory, the application of monitoring, in combination with modelling, facilitates the effective characterization of spatial and temporal variations in air pollutant concentrations. Such concentrations are evaluated based on local

guideline values to determine the need for devising emission control strategies. Dispersion modelling is used to predict ambient air pollutant reductions possible through the implementation of specific emission control strategies. Emission control strategies may then be selected which are able to ensure compliance with the local guideline value, the socio-economic acceptability and technological feasibility of such strategies having been assessed. The control measures selected need to be enforced, and if the standards are achieved, they need continued enforcement. If the standards are not achieved after a reasonable period of time (i.e. within the permissible timeframe to be stipulated), the emission control measures may need to be revised.

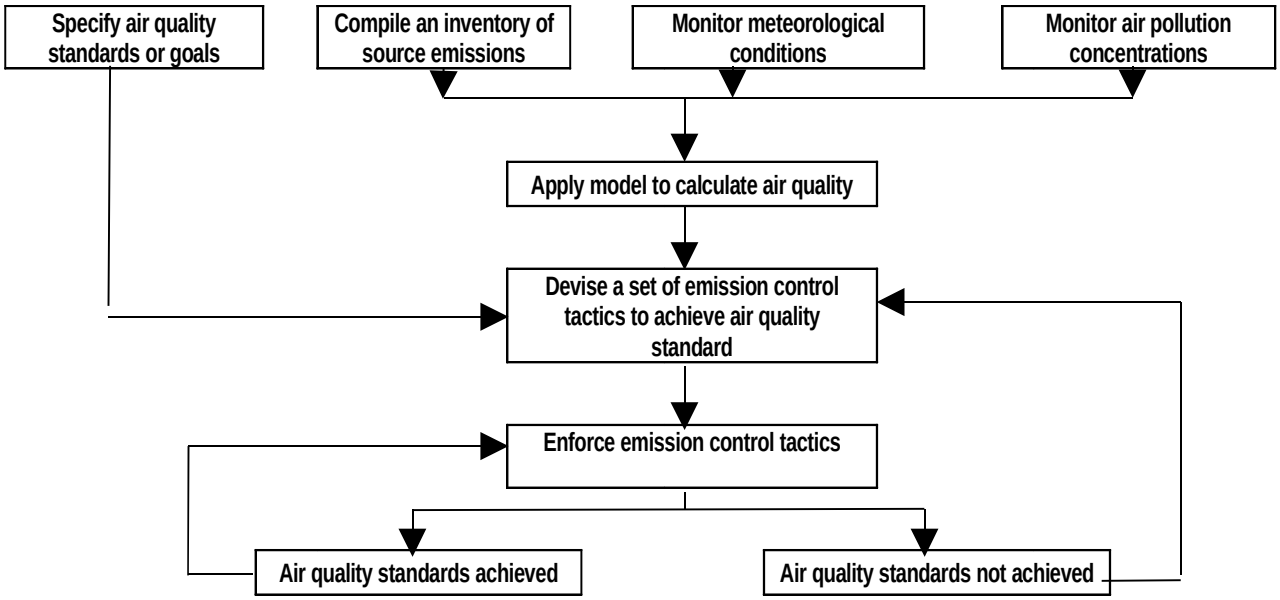


Figure 1. Development of an air quality management strategy through the implementation of select air quality management tools (after WHO, 2000).

An integrated air quality management system, which comprises components such as an emissions inventory and air quality monitoring and modelling, therefore forms the basis of effective air pollution control and quality management. The configuration of the management system recommended for implementation by EMM is illustrated in Figure 2. System components proposed for implementation in the short-term are indicated by solid lines, with components to be added at a later stage indicated by dashed lines.

Components of the basic Air Quality Management System proposed for implementation by the EMM within the short-term, i.e. next 1-2 years, include the following:

- Local air quality guidelines
- Emissions inventory
- Air quality and meteorological monitoring network
- Routine reporting mechanisms and protocols – including procedures for internal reporting and for reporting to DEAT, GDACEL and the public
- Public liaison and consultation mechanisms

Based on the outputs of the basic air quality management system, health risk assessments and damage assessments can be undertaken and impacts coasted in the medium-term (3-5 years). Such assessment may be undertaken in the following ways: (i) in house, through the selection and acquisition of suitable models and acquisition and preparation of locally – derived input data, (ii) in house, through the application of manual calculators based on locally-derived data and international protocol, or (iii) externally, through the appointment of consultants on a project-by-project basis.

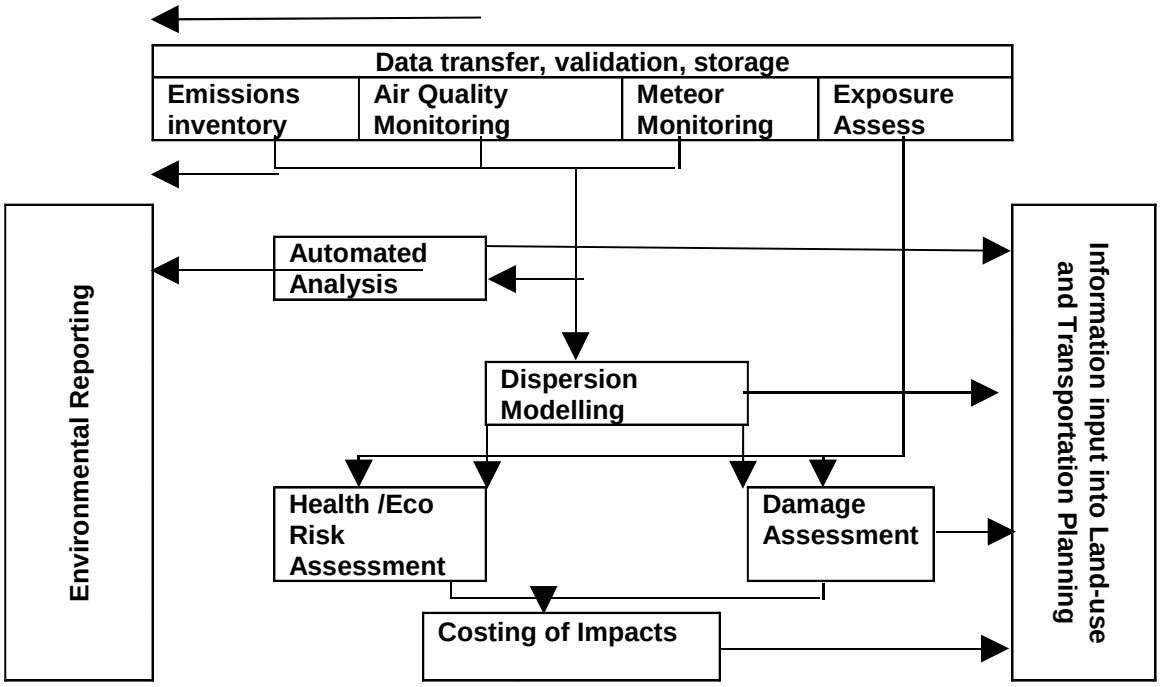


Figure 2. **Air quality management system recommended for implementation by EMM**

A synopsis of the specific actions required and timeframes for establishing and operating the air quality management systems outlined is given in the table below:

Action:	**Target Date:**
Consolidation of an ambient air quality and meteorological monitoring network, including: the new stations at Olifantsfontein and Etwatwa, and automated data transfer and first-order validation	June 2005
Investigate the feasibility of designating an air pollution hotline and air quality information and liaison officer duties	July 2005
Consult with industries required to fund ambient air quality monitoring and integration of data from such monitoring into EMM's air quality data base	On-going
Establish an electronic, centrally-accessible complaints register	December 2005
Evaluation and costing of passive diffusive monitoring and biomonitoring campaigns	December 2005
Define and implement a schedule for routine reporting	March 2006
Arrange, advertise and conduct 6-monthly public meetings	July 2006
Extend ambient air quality and meteorological monitoring network to include 2 additional stations. Possible stations and sites include: (i) stationary site at Westville; (ii) stationary site in Germiston at Industries West, and (iii) transferable station for sampling at traffic intersections	July 2006
Purchase and install Emissions Inventory and Air Dispersion Modelling software	July 2006
Collation of source and emissions data for all major sources (on-going) and initial population of Emissions Inventory software	December 2006
Population of the Air Dispersion Modelling software and simulation of ambient air pollutant concentrations across the Metro	July 2007

4.3 Emission Quantification and Reduction Programme

The following internationally adopted protocol for developing of an emission reduction programme is recognized:

1. Identification of pollutants to be controlled.
2. Identification of all sources of each pollutant - and for each source determine:

- Quantity of emissions (including temporal patterns in extent of emissions).
- Percentage contribution to total emissions of a pollutant.
- The height of emission - e.g. ground, medium elevated or high elevated source.
- Likelihood of human exposure to emissions (exposure index) - e.g. emissions near population concentrations.

3 Identification of air pollution reduction strategies:

- List and description of possible strategies for each source.
- Explanation of implementation of each measure.
- Quantification of reduction of ambient concentrations as a result of implementation of each strategy through use of dispersion model analysis.
- Do cost-benefit analysis of controlling each source with each strategy. Cost-benefit analyses should include the consideration of:
    - Source characteristics (i.e. percentage contribution, height of emission, and exposure index) - to select the sources to be controlled,
    - Reduction of ambient concentrations as a result of implementation of each strategy -identify most effective strategies for ambient pollution abatement.
    - Technical feasibility of each strategy.
    - Socio-economic impacts of each strategy - determine the feasibility of strategies within the socio-economic context.

An effective air quality management framework is not currently in place within the Ekurhuleni Metropolitan Municipality due to manner in which air pollution has historically been controlled. Without such a system: (i) insufficient data exists for certain sources on which to determine whether or not the implementation of certain emission reduction measures are justified, and (ii) progress made by control measure implementation can not be quantified. It was therefore decided to focus on air quality management system development in the short-term given that such a system is not currently in place and is required to provide the basis for the emission reduction programme development outlined above.

In terms of source specific actions to be undertaken by EMM, actions aimed at both source quantification of all sources and emission reduction for major sources has been identified. It is intended that priority be given to the reduction of emissions of *priority* pollutants from *key* sources (with the aim of reducing exposures in highly impacted areas) even though a comprehensive management system is not yet in place.

4.3.1 Domestic Fuel Burning

4.3.1.1 Short-term Actions (Years 1 & 2)

- For Brownfield sites, emphasis is to be placed on implementation of Basa njengo Magogo method of ignition. At least two main campaigns will be implemented within the next two years, viz.:
- Tembisa Basa njengo Magogo project sponsored by DME. The contract to undertake the project has been awarded by DME to Menyetla Projects (Pty) Ltd and Palmer Development Consulting (PDC). The project officially started on the signing of the contract on 13 September 2004and will run until October/November 2005. EMM's participation in this project has been requested by the project team. The project will target 20 000 households

within Tembisa. Project tasks, milestones and target dates are given in Appendix D.

- Etwatwa Basa njengo Magogo project to be implemented by EMM. Planning is still required to be done for this project and funds established. It is intended that the project target 20 000 households and that DME recognition of the project be officially obtained so that the EMM logos and marketing material can be used. EMM personnel have already received training on the EMM method of ignition.

- The integration of energy efficiency measures (e.g. solar passive design) into Greenfield projects is under consideration by the EMM Department of Housing. This may entail the amendment of the Metro's building codes and housing policy to ensure that all new housing developments are energy efficient.
- EMM will establish its urban air quality dispersion model to simulated air pollution concentrations associated with domestic fuel burning emissions.

4.3.1.2 Medium-term Actions (Years 3-5)

- EMM will facilitate the investigation and identification of suitable alternatives to household burning of so-called dirty fuels including:
  - Low smoke fuels
  - Renewable energy alternatives
  - increased energy-efficiency through retrofitting for existing dwelling
  - Energy demand management

  Emphasis will be place on improved access of poorer households to clean energy, giving consideration to potential resourcing opportunities such as the Cleaner Development Mechanism and carbon credit trading systems.

The energy efficiency measures intended for implementation in the short- and medium-terms are in line with the DME Draft Energy Efficiency Strategy (April 2004) and the National Energy Regulator's Regulatory Policy on Energy Efficiency and Demand Side Management (EEDSM) for South African Electricity Industry (May 2004). The DME draft policy provides specific targets for reducing energy demand by 2014 within given demand sectors, with an overall target of 12% reduction in consumption. The identification of renewable energy alternatives is in line with the White Paper on the Promoting of Renewable Energy and Clean Energy Development, Part One, Promotion of Renewable Energy, Department of Minerals and Energy, Pretoria, August 2002.

4.3.2 Mining Operations and Tailing Impoundments

4.3.2.1 Short-term Actions (Years 1 & 2)

- EMM will acquire representation on the inter-departmental committee tasked with the regulation of mining operations and tailings impoundments (DWAF, DME and GDACE are currently represented on the committee). Through this committee, and other existing structures, the EMM will Endeavour to obtain support for the local implementation of the following measures:
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  - Require that mining companies compile emissions inventories for their operations, including their mineral processing plants, and communicate source and emissions information to the Metro for inclusion in its metro-wide emissions inventory database within 6 months of AQMP implementation.
  - Require that all mines (operational mines and mines scheduled for closure) compile and implement comprehensive dust management plans as part of their EMPRs. The main components of a comprehensive dust management plan are outlined in Appendix E and demonstrated for mine tailings impoundments.
  - Require dust fall monitoring and reporting to the Metro by open cast nines, mines with significant unpaved haul roads (> 200 m) and mines with - mine tailings impoundments. Dust fall monitoring should be undertaken at representative locations for a period of 3 or more months, including the windy season, to prove compliance with dust fall guidelines. Dust fall monitoring should be continued until compliance can be proven. Dust fall monitoring should be reinitiated following significant process changes or changes in the status of

tailings impoundments.

- Require all open cast mines, mines with significant unpaved haul roads (> 200 m) and mines with mine tailings impoundments to include dust management and post decommissioning dust management/rehabilitation and other air quality related considerations in the calculation of the financial quantum (closure cost determination).
- Implementation of local dust deposition evaluation criteria (see Section 4.1.2.1) in order to ensure that imitative action is undertaken when alarm thresholds are exceeded.

- EMM will ensure that mines are fulfilling their obligations, as part of their dust management plan implementation, in terms of making dust monitoring and management information available to neighbouring communities and interested and affected parties. EMM personnel may attend and where necessary facilitate public forums.

4.3.2.2 Medium-term Actions (Years 3-5)

- EMM will request that DME:
  - Ensure that all mines:
    (i) Have EMPRs approved by the DME
    (ii) Can demonstrate & periodically report on compliance to EMPR commitments with particular reference to pollution to the atmosphere
    (iii) Have determined the financial quantum and provide for the prevention & management of pollution to the atmosphere
  - Challenge applications for mineral right conversion if mines do not comply with requirements as set out in their EMPR documents
- EMM will require all mines closing to comply to their closure commitments in general and specifically with dust management plans and rehabilitation objectives.
- EMM will require all operating mines to demonstrate compliance to dust deposition guidelines and require that imitative action be undertaken when alarm thresholds are exceeded.

4.3.**3 Road Transportation**

4.3.*3.1* *Need for Inter-departmental Collaboration*

Important relationships exist between air quality management, land use planning, housing and transportation planning. New land use developments can influence both travel patterns and exposure levels. The sitting of a residential area in close proximity to an industrial area would, for example, result in increased levels of human exposure to the emissions generated by the industry. Whereas extended transportation networks and increased traffic flows resulting from such new developments would directly influence air quality through enhanced tailpipe emissions of particulate matter and increased entrainment of dust on roadways. Unless this relationship is recognized and channels of communication established between local and regional agencies responsible for land use planning, air quality management and transportation planning, air quality management in unlikely to succeed.

Local governmental departments tasked with air quality management in the UK have found that the successful management of vehicle emission can only be achieved by means of the integration of air quality considerations into Local Transport Plans (LTPs) (Woodsfield *et* a/., 2004). Similar experiences are documented for the US and various Asian and European countries. It is therefore recommendable that the Environment and Tourism Department aim to use existing transportation planning processes for the achievement of vehicle emission reductions.

The Ekurhuleni Transportation Planning Department is in the process of developing an Integrated Transport Plan (ITP) for the Metro, as prescribed by both the new National Land Transport Transition Act and the Local Government Transition Act. The EMM ITP is intended to address public transport services (minibus-taxi, subsidized bus and rail) as well as private transport and freight transport. African Consulting Engineers have been subcontracted to develop EMM's Regional Transportation Model. This model is intended to be used for scenario modelling in support of ITP development. Baseline (2001) model outputs, comprising spatial traffic flow information, were scheduled to be made available in October 2004 following which scenario modelling was to be initiated.

It is notable that various of the programmers likely to be included in the EMM ITP will be conducive to vehicle emission reductions for two main reasons: (i) local transportation policy is influenced by international practices and in many countries air quality considerations have already influenced transportation planning practices, and (ii) measures implemented to meet certain of the key objective of transportation planning - such as reductions in travel trips and travel times through improved public transport systems and congestion management - are also likely to result in total vehicle emission reductions. This is evident from the ITP recently issued for the City of Joburg (May 2003).

4.3.3.2 ***Need for Inter-governmental Collaboration***

Collaboration between local, provincial and national government is required to secure the effective regulation of vehicle emissions. National government is primarily responsible for legislative controls with transportation management measures most frequently being implemented by provincial and local government. Transportation management measures and emission testing strategies by local authorities are likely to be more successful if implemented uniformly across neighbouring cities and metros. It is for this reason that EMM

Is committed to close consultation with adjacent local authorities and Gauteng provincial departments in developing its ITP.

4.3.3.3 Short-term Measures (Years 1 & 2)

-An *Inter-departmental Transport Liaison Group* will be established comprising members of the Department of Environment and Tourism (Quality Control and Law Enforcement), Department of Health and Social Development (Integrated Pollution Control division of Environmental Health) and Transportation Planning. This group will initially meet regularly (monthly) to facilitate the initiation of information sharing procedures and the implementation of several of the short-term measures outlined below.

-Methods used by each service delivery region in their testing of diesel vehicle emissions will be standardized and a target number of vehicles to be tested each month within each Region established.

- The cooperation of metro police will be established for the purpose of supporting the diesel vehicle emissions programme.
- EMM coordinates regular emission testing of metro buses at the municipal testing station when such vehicles undergo their regular Certificate of Fitness examinations.
- EMM will design a more comprehensive and effective vehicle emission testing programme for implementation in the medium-term in consultation with Gauteng province and neighbouring municipalities[2]. This programme may include the following:

  -Introduction of a system whereby municipal vehicle testing stations perform diesel smoke testing for roadworthy inspections, Certificate of Fitness inspections and re-testing for the diesel emission programme;

  -More effective vehicle testing equipment and protocols applicable to the measurement of smoke emissions from diesel vehicles;

  -Vehicle testing equipment and protocols applicable to the measurement of other parameters and/or vehicle types in line with impending National vehicle emission standards and associated monitoring protocols; and

  -The drafting and implementation of local by-laws aimed at supporting the introduction and implementation of alternative vehicle emission testing approaches.

[2] This will not be required if the DEAT establishes new regulations pertaining to vehicle emissions testing in the interim under the impending Air Quality Act

-ETD will obtain information required for the quantification of vehicle emissions from Transportation Planning, viz.:
-spatial information on road network
-technology mix (indicating number of petrol and diesel vehicles, with a distinction made between various vehicle types) - spatial variations in mix if available
-vehicle age data'(taking into account traffic mix) - spatial variations where available
-vehicle population data - spatial variations in vehicle nos. per vehicle

(Transportation Planning will make available information from the transportation model developed by Africon.)

-Transport-related monitoring requirements will be integrated into the EMM ambient air quality monitoring activities through the purchase, commissioning and operation of a transferable ambient air quality monitoring station (see Section 5).
-Transportation management measures implemented in other cities, locally and abroad, for the purpose of vehicle emission reduction will be identified by ETD for consideration by Transportation Planning and possible inclusion in the ITP.
-Research will be encouraged on cleaner transportation technologies through liaising with the Transportation Planning project manager on the Clean Transport Technology Project via the *Inter-departmental Transport Liaison Group.* EMM will also liaise with GDACE to integrate findings from their cleaner technologies initiative and to avoid duplication.

4.3.3.4 Medium-term Measures (Years 3-5)

- Results from local and provincial cleaner transportation technology research initiatives will be used to inform public and government related transport decisions.
- A *Transportation and Land-use Planning Liaison Group* should be formed, comprising members from the Air Quality Management function, Transportation Planning, Spatial Planning and Housing. This Group should be an extension of the *Inter-departmental Transport Liaison Group* formed previously and should aim to integrate environmental considerations, including air quality issues, into long-term transportation, housing development and spatial planning processes.
- EMM will set up its urban air quality dispersion model to simulated air pollution concentrations associated with transportation emissions. Air quality improvements due to the implementation of selected transportation measures will also be simulated.
- ETD will quantitatively evaluate the air quality implications of proposed transportation management measures and transportation projects through the application o the urban air quality dispersion model. Findings will be communicated to Transportation Planning for consideration during decision making.

4.3.4 Waste disposal and treatment

4.3.4.1 Short-term Actions (year 1-2)

Landfill Operations:

- EMM will require that landfill operations within the metro consistently meet DWAF minimum requirements.
- ETD personnel will conduct site inspections with DWAF and/or GDACE personnel. A checklist, comprising DWAF and GDACE landfill evaluation criteria in addition to other 'good practices' pertaining to landfill management and air pollution control, will be compiled by ETD to inform such site inspections.
- EMM will request to be represented at DWAF meetings held to discuss local landfill sites. (DWAF national and regional departments and landfill operators currently attend such meetings).
- EMM will require that "large, general" and "hazardous" landfill operations in the Metro, and other local landfill operations found to consistently not comply with Minimum Requirements, undertake the following:

-compile a speciated substance emissions inventory based on subsurface gas network sampling
-commission ambient air quality monitoring and/or air dispersion modelling of select toxic and odoriferous substances - with substances selected on the basis of the site-specific emissions inventory
-commission an impact and risk screening study to determine whether measured and/or modelled air pollutant concentrations exceed appropriate health and/or odour thresholds
-report source, emissions and monitored and predicted ambient air pollutant concentration information to EMM, flagging air pollutant concentrations resulting in potentially unacceptable health or odour risks
-commission a quantitative health risk assessment should the potential for health risks be noted based on the screening study and communicate the findings of this assessment to EMM

- Short-term methods of waste recycling will be investigated, e.g. through the support of local buy-back centres.

Incineration:

- EMM will initiate an investigation into the legal status of medical waste incinerators operating within the Metro. In cases where incinerators are operating without the necessary registration certificate, DEAT" will be notified and a timeframe established within which such operations are required to apply for such a permit (or atmospheric emission license, should the Air Quality Act have been promulgated).
- EMM will consult with DEAT and GDACE to ensure that all incinerators are permitted and are operating according to permit requirements. This will require that, among other things, stack emissions testing be commissioned by such operations to prove compliance with emission limits specified for incinerator operations. Emission limits are given for medical waste incinerators for the following pollutants: particulates, cadmium, mercury, thallium, chromium, beryllium, arsenic, antimony, barium, lead, silver, cobalt, copper, manganese, tin, vanadium, nickel, chloride, hydrofluoric acid and sulphur dioxide.

Sewage and Waste Water Treatment Works

- EMM will require that large and/or poorly managed sewage and waste water treatment works operating within the Metro undertake the following:
  -compile an emissions inventory
  -commission ambient air quality monitoring and/or air dispersion modelling of select toxic and odoriferous substances - with substances selected on the basis of the site-specific emissions inventory
  -commission an impact and risk screening study to determine whether measured and/or modelled air pollutant concentrations exceed appropriate health and/or odour thresholds

  -report source, emissions and monitored and predicted ambient air pollutant concentration information to EMM, flagging air pollutant concentrations resulting in potentially unacceptable health or odour risks
  -commission a quantitative health risk assessment should the potential for health risks be noted based on the screening study and communicate the findings of this assessment to EMM

4.3.4.2 Medium-term actions (Years 3-5)

- Design and initiate an education and awareness campaign on waste segregation.
- Commission a cost-benefit study on waste segregation and recycling strategies applicable for implementation within EMM
- Consolidate findings of investigations into alternative treatment and disposal options and support additional investigations where required. Integrate findings on alternatives in EIA reviews and local waste management policies
- Collate source and emissions data for incinerator operations and undertake an air quality impact assessment, including a health risk screening study, to determine the acceptability incinerators for the purpose of informing the permitting/atmospheric emission licensing process.

4.3.5 Industry, Fuel Burning Appliances and electricity generation

4.3.5.1 Short-term Measures (Years 1 & 2)

- EMM, in consultation with the national air pollution control officer currently responsible for Scheduled Processes within the Metro, will:
  - Require that concerns undertaking Scheduled Processes provide proof of registration under the APPA and demonstrate compliance with permit conditions.
    -Require that *certain* industries and commercial and institutional concerns undertaking combustion processes compile emissions inventories for their operations and communicate source and emissions information to the Metro for inclusion in its metro-wide emissions inventory data base.
    - Criteria to be used by EMM in determining which operations are required to undertake emissions inventories and report source and emissions data are given in Appendix F.
    - Source and emissions data to be reported to EMM within 6 months of the AQM Plan being implemented are outlined in Appendix G. The methodological approaches used in the estimation, modelling and calculation of emissions must be in line with accepted international practices.
  - Encourage industries to compile and implement emission reduction programmes in instances where such operations are expected to contribute significantly to cumulative air pollutant concentrations in areas where pollution concentrations exceed local air quality objectives.

-Proponents of new developments must prove compliance with local ambient air quality objectives, taking into account existing or background air pollutant concentrations. Proponents must also demonstrate that best practicable environmental options are being implemented where applicable.

- EMM will collate information related to small scale non-domestic fuel burning appliances required for the establishment of emissions and modelling of air quality impacts (i.e. operations not included under the previous point), viz.:
  -location of appliance
  -company name and contact details
  -type of appliance
  -type of fuel in use
  -sulphur content of fuel
  -ash content of fuel (where appropriate)
  -quantity of fuel used
  -Scheduling of operation (continuous, intermittent - two hours per day, etc.)
  -control measures in place
  -control efficiency
  -stack height
  -inner stack diameter
  -gas exit temperature
  -gas exit velocity or volumetric flow
  -stack monitoring data (where available)
- EMM will reinforce the rule that the installation of all new non-domestic fuel burning appliances and any major appliance renovation or alteration project will require the notification of the Metro. Appliance and fuel information listed above will be required to be reported prior to approval of the commencement of the operation.
- EMM will estimate emissions for non-domestic fuel burning appliances for inclusion in metro-wide emissions inventory data base
- EMM will set up its urban air quality dispersion model to simulated air pollution concentrations associated with Scheduled Processes/Listed Activities and small non-domestic fuel burning appliances.

4.3.5.2 Medium-term Measures (Years 3-5)

-Review and revise permits / atmospheric emissions licenses of Scheduled Processes / Listed Activities, taking into account best practices and cumulative air pollutant concentrations.
-Set specifications on combustion efficiency applicable to all new combustion devices.
-Liaise with Eskom on demand side management measures applicable to the commercial and

industrial sectors.
-Investigate the potential for introducing alternative tariff structures for the purpose of encouraging on-site co-generation and the introduction of renewable.
-Investigation of the potential for introducing market incentives and disincentives for the purpose of encouraging emission reduction by industrial and power generation processes.

4.3.6 Airports

4.3.6.1 Short-term Measures (Years 1 & 2)

- EMM should require that all airports operating within the Metro conduct an emissions inventory and report source and emissions data to ETD for inclusion in the Metro's emissions inventory.
- Johannesburg International Airport, due to the extent of its operations, should be required to undertake a comprehensive air quality impact assessment and to integrate air quality considerations into their daily operations. The air quality impact assessment sources make provision for:
  - establishment of an emissions inventory , in which emissions from all airport-related activities are quantified;
  - projection of increases in emissions associated with various stages of the airport's development as expressed, for example, by specific growth points in passenger numbers;
  - prediction of current and potential future contributions to ambient air pollutant concentrations;
  - identify a suitable site(s) for ambient air quality monitoring based on predicted impact zones and sensitive receptor locations;
  - ranking of airport activity related sources based on their current and future contributions to human health risks; and
  - Identification of emission reduction opportunities and cost-effective emission abatement strategies.

  Should JIA already have completed such an assessments, the findings of the study should be made available to EMM. If additional work is required to meet the above requirements, such work should be completed within a period of 8 months.

- EMM will set up its urban air quality dispersion model to simulated air pollution concentrations associated with airport emissions.

4.3.6.2 Medium-term Measures (Years 3-5)

-EMM will determine whether airports in the Metro, other than JIA, need to conduct comprehensive air quality impact assessment based on in-house dispersion model projections. Such assessments will be used to determine the need for ambient air quality monitoring and emission management planning and implementation by such airports.
-Johannesburg International Airport should undertake ambient air quality monitoring at the site(s) selected on the basis of the air quality impact assessment. The provisions in Section 5.1.5, pertaining to the integration of industry-funded air quality monitoring stations in the urban monitoring network, will apply.

- Johannesburg International Airport is required to implement an emission management programme and to report progress on a period basis to EMM. The format and frequency of such reporting is to be established based on consultation with ACSA.

The short- and medium-term measures listed above are in line with the National Policy on Aircraft Engine Emissions. The main aim of this policy is to determine the extent of engine emission pollution and to support planning and control at airports. Policy objectives include: (i) implementation of ambient air quality measurement and monitoring of air traffic movements to estimate aircraft engine emissions; (ii) the assessment of ambient air quality impacts associated with aircraft-related emissions; and (iii) the reduction of pollutant emissions related to airport operations. The proposed policy clearly states that "to do nothing" is unacceptable when addressing issues related to aircraft engine emissions.

4.3.7 Other Sources

4.3.7.1 Short-term Measures (Years 1 & 2)

- Identify and quantify additional sources of pollution. Specific attention should be paid to:
  -Vehicle entrainment from unpaved public roads
  -Agricultural emissions and veld burning
  -Railway transport
- Establish routine data retrieval mechanisms for the purpose of updating the emissions inventory (e.g. Fire Departments - request data be kept on locations of veld fires and extent of areas burned).
- Control the burning of grass by municipal workers along highways and elsewhere.
- Support national legislation aimed at controlling copper wire burning for the purpose of wire stripping.
- Investigate the use of by-law implementation for the purpose of: (i) controlling track out from construction sites, (ii) stipulating the need for dust fall monitoring and reporting of results during large-scale construction and demolition projects.
- Investigate measures to be used in the control of tyre burning.

4.3.7.2 Medium-term Measures (Years 3-5)

- Identification of emission reduction measures for other sources predicted on the basis of the quantitative emissions inventory and in-house atmospheric dispersion modelling or external studies to be significant in terms of health risks or nuisance impacts.

5. AQM Plan Approval and Review Process

5.1 AQM Plan Approval

The following process was followed in the drafting of the Ekurhuleni AQM Plan:

- Establishment of the following structures to provide guidance to the AQM Plan development project team:
  - Technical Working Groups (TWGs) - established to review the technical merit and feasibility of the plan during the development phase. TWG members included representatives from EMM Departments responsible for transport, housing, urban planning, environmental health and environmental management in addition to GDACE personnel and various experts within the private sector.
  - Air Quality Stakeholder Group (AQSG) - comprising interested and affected parties including parties affected by air pollution and those whom may be impacted by interventions aimed at reducing the impacts of air pollution, e.g. business, industry, NGOs, CBOs and labour.
- Compilation of Discussion Documents and a Draft Air Quality Management Plan for distribution to and work shopping with the Technical Working Groups and the Air Quality Stakeholder Group (August to November 2004).
- Presentation of the Draft AQM Plan to the EMM Portfolio Committee (November 2004)
- Integration of all comments received from the TWGs, AQSG and EMM and compilation of the Draft Final Plan.
- Presentation of the Draft Final AQM Plan at a Public Workshop (24 November 2004) and placement of copies of the Draft-Final Plan in public places for review.
- Integration of all comments received from the TWGs, AQSG, EMM and the public and compilation of the Final AQM Plan (January 2004).
-

The Final AQM Plan was submitted to[3]:

[3] Although it was intended that copies of the final plan be placed in public places, it was decided not to do so given that no substantial changes to the Draft-Final Plan were necessary. Advertisements were however placed to notify the public that the AQM Plan development process had been finalized and that the Draft-Final Plan previously placed in all municipal libraries (46 libraries) within Ekurhuleni, accurately reflected the contents of the Final Plan.

- Environment and Tourism Department, EMM, for distribution to necessary departments.
- Members of the TWGs and AQSG.

AQM Plan approval is however dependent not only on stakeholder and general public acceptance but also on review and authorization by provincial and possibly by national governments. The guidelines for how AQM Plan approvals will take place have not yet been established by either. It is however anticipated that such guidelines will be issued within the next two years. It is intended that the AQM Plan be approved and implemented by EMM in the interim with the Plan being revised and submitted to the necessary national and/or provincial authorities for approval once the necessary guidelines are in place.

5.2 AQM Plan Review

Once approved by EMM in consultation with DEAT and GDACE, the AQM Plan and the functional and operational framework within which the plan is implemented will be reviewed regularly to ensure its continuing suitability, adequacy and effectiveness. The aim of the review is primarily to address the possible need for changes to functional and operational structures, AQM systems, management objectives (etc.) in light of poor performances, changing circumstances and the commitment to continual improvement.

In the coming year(s) the Air Quality Management Plan will be reviewed based on:
-final stipulations within the National Air Quality Management Act
-national regulations pertaining to ambient air quality standards
-national regulations pertaining to ambient air quality monitoring for compliance assessment purposes
-national regulations pertaining to emission standards
-national regulations for source monitoring methods suited to assessing compliance with emission standards
-Proposed guidance reports to be issued on: (i) air quality assessments, (ii) the use of indirect methods for air quality charactisation (e.g. Modelling), and (iii) air quality management plan development and implementation.
-new DEAT and GDACE criteria pertaining to air quality management and air pollution control

Progress made in AQM Plan implementation will be reported on annually. The AQM Plan will initially be revised in two years (i.e. January 2007), following which it will be revised every 5 years unless otherwise required by DEAT or GDACE. The draft revised AQM Plan will be submitted to the DEAT and GDACE for approval and made available to the public for comment prior to finalization

ANNEXURE B

Project Done On Behalf Of: Ekurhuleni Metropolitan Municipality -Department of Environment & Tourism

FINAL REPORT

BACKGROUND INFORMATION DOCUMENT- AIR QUALITY BASELINE ASSESSMENT FOR THE EKURHULENI METROPOLITAN MUNICIPALITY

Report No.: APP/04/EMM-01 rev 1 DATE: 30

November 2004

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EXECUTIVE SUMMARY

1. INTRODUCTION

Ekurhuleni Metropolitan Municipality, which comprises a mixture of industrial, mining, commercial, agricultural and residential land use activities in close proximity to one another, faces complex and pressing air pollution challenges. Atmospheric emissions within the Metropolitan include vehicle tailpipe emissions, household fuel combustion products, industrial releases, waste disposal related emissions, wind-blown dust from mine tailings impoundments, biomass burning emissions and fugitive dust emissions from vehicle-entrainment, materials handling and agricultural activities.

The Ekurhuleni Department of Environment and Tourism has been tasked with the implementation of effective air quality management and planning as part of its larger environmental management responsibilities. The need for Ekurhuleni Metropolitan Municipality to undertake air quality management and planning is furthermore stipulated in the National Environmental Management: Air Quality Bill scheduled to replace the Air Pollution Prevention Act of 1965. According to this Bill local authorities will be required to compile and include Air Quality Management (AQM) Plans as part of their Integrated Development Plans. Such authorities will be required to develop, implement, review and revise their AQM Plans on an on-going basis in terms of the impending Act.

Airshed Planning Professionals (Pty) Ltd were appointed by the Department of Environment and Tourism within Ekurhuleni Metropolitan Municipality to undertake an air quality situation assessment for the Metro. The collation, analysis and presentation of relevant and recent existing information on sources, emissions, ambient air quality and air pollution control represented an important first step in the intensive air quality management plan development process initiated by Ekurhuleni Metro.

2. TERMS OF REFERENCE

The main focus areas of the baseline assessment were as follows:

-Identification of sources, pollutants and areas of concern based on existing knowledge of ambient air pollution concentrations within the Metro;
-Identification of critical gaps pertaining to comprehensive ambient air quality baseline characterisation;
-Inventory of current management and operational structures pertaining to air pollution management within the Metro;
-Inventory of current functions pertaining to air pollution control or air quality management within the Metro, including functions undertaken at national, provincial, metropolitan and service delivery region level;
-Inventory of all ambient air quality monitoring currently underway in Ekurhuleni including monitoring undertaken by local industries;
-Establishment of criteria to which the AQM Plan for Ekurhuleni will need to conform to be in line with national and other requirements;
-Determine the nature and status (in terms of degree of completion) of AQM Strategies and AQM Systems developed by other metropolitan areas, e.g. City of Cape Town, Ethekwini Metropolitan, City of Joburg; and
-Review of best international practices pertaining to AQM Plan development and implementation of relevance within the context of Ekurhuleni.

3. STUDY AREA

The Ekurhuleni Metropolitan Municipality is located in the eastern region of the Gauteng Province. It borders the City of Johannesburg in the west, the City of Tshwane in the northwest, the Kungwini Municipality to the north and the Delmas Municipality to the east. Midvaal and Lesedi municipalities, which form part of the Sedibeng District Municipality are located to the south of Ekurhuleni.

Ekurhuleni extends for -45 km from west to east, and for -55 km from north to south, covering an area of about 1 923 km^2. The metropolitan is divided into Northern, Southern and Eastern Service Delivery Regions (SDRs). The SDRs cover the following areas:

- *Southern SDR:* Germiston (as regional centre), Alberton, areas of Boksburg and section of Freeway Park, amongst others.
- *Eastern SDR:* Springs (as regional centre), Nigel, KwaThema, Tsakane, Duduza, part of Benoni, Brakpan and Boksburg, and the Etwatwa-Daveyton area.
- *Northern SDR:* Kempton Park (as regional centre), Tembisa, part of Benoni, Edenvale and part of Germiston, including Bedfordview and Primrose.

3.1 Topography and Meteorology

The topography of Ekurhuleni is generally undulating with elevation ranges from 1460 to 1760 m. Higher lying areas and ridges occur on the western side of the metropolitan. The region is characterized by a temperate climate. Rainfall averages about 710 mm per annum, but significant inter-annual variations in total rainfall are experienced. Rain falls predominantly during summer months, frequently in late-afternoon electrical storms.

During winter months the region is dominated by the continental high pressure system which is characterized by large-scale subsidence, clear skies, light winds and strong temperature inversions. Northerly to north-westerly winds prevail during much of the year due to the prevalence of the high pressure system. Although such winds continue to dominate during winter months, the northward shift of the high pressure belt and resultant influence of westerly wave disturbances on the region gives rise to an increase in the frequency of winds from the south-westerly sector. An increase in the frequency of north-easterly wind during spring and summer months is the result of the southward migration of the high pressure belt, with airflow being influenced both by anticyclonic subsidence and easterly wave systems.

Multiple elevated inversions occur in the middle to upper troposphere as a result of large-scale anticyclonic subsidence. Three distinct elevated inversions, situated at altitudes of approximately 700 hPa (-3 km), 500 hPa (-5 km) and 300 hPa (-7 km), were identified over southern Africa. The height and persistence of such elevated inversions vary with latitudinal and longitudinal position. During winter months the first elevated inversion is located at an altitude of around 3 km over the plateau. In summer this inversion is known to increase in to 4 to 5 km over the plateau. Given the elevation of Ekurhuleni it is evident that the dispersion of air pollutants is frequently confined within the 1300 to 1500 m of atmosphere above the ground. Due to the occurrence of nocturnal, surface-based temperature inversions the mixing layer may range diurnally from a depth of 0 m during the night-time to the base of the lowest-level elevated inversion during unstable, day-time conditions (i.e. 1300 to 1500 m).

3.2 Industrial Activities and Electricity Generation

Ekurhuleni comprises the largest industrial area in the country. Approximately 40% of all industrial activity in Gauteng Province derives from the EMM area. The Gauteng Spatial Development Framework has identified EMM as a core focus area for future economic development in the province (Ekurhuleni 2003 State of Environment Report). Industrial activities are primarily located within the south-western part of the metro, in areas such as Germiston and Alrode. In Kempton Park and Edenvale, some industrial activity developed round the airport. Industrial activities are also closely linked to the railway system.

Approximately 8000 industries and 5000 supporting enterprises were reported to be located in the EMM during 2003. Source and emissions data collated during the baseline assessment indicates that there are at least 320 Scheduled Processes currently in operation within the EMM, with local industries undertaking 41 of the 72 processes listed in the second schedule of the Air Pollution Prevention Act (Act 45 of 1965). Processes conducted include sulphuric acid, phosphate fertilizer, nitric acid, chlorine, cement, acid sludge, iron and steel, power generation, ammonia, macadam preparation, glass, nickel and pulp and paper processes.
The industrial operations are located within approximately 20 separate industrial areas that are concentrated in seven industrial nodes, including:

Four nodes lie directly adjacent to the Greater Johannesburg Metro:

- The Olifantsfontein and Clayville Industrial areas to the north of Tembisa -accommodates predominately heavy industry.
- The Isando, Spartan, Jet Park complex - located just west of Johannesburg International Airport - comprising predominately light and heavy industrial activities. Edenvale, with is few smaller light industries forms part of this node.
- The Germiston Industrial area, comprising portions to the east and west of Germiston CBD, Wadeville, Alrode and Roodekop.

The remaining three nodes lie in the central, eastern and southern parts of the EMM:

- The Boksburg East, Anderbolt, Benoni South and Apex industrial areas - represent fairly old industrial areas.
- The Brakpan and Springs industrial area to the east and the Nigel industrial area to the south represent smaller industrial, areas.

Only one power station generating electricity for the national grid is located within Ekurhuleni, viz. Kelvin Power Station. Located in Kempton Park, Kelvin Power station is coal-fired and has a total capacity of 600 MW. Although new bag filters were installed during 2003 to restrict particulate emissions from the power stations -70 m stacks, gaseous emissions from the power station are currently uncontrolled.

3.3 Household Energy Use

Although most households within the EMM use electricity for lighting (75%), heating (62%) and cooking (66%), coal, paraffin and candles are shown to still be important energy sources. Paraffin is used for heating (13%) and cooking (26%), while 19% of households use coal as a heating source and 6% as a cooking source. Wood is used by <1.5% of households for cooking and heating purposes. The black population is most dependent on coal, paraffin and candle use. The distribution patterns of fuel use are linked with the former townships and informal residential areas.

The continued use of coal and wood by a large section of the population within Ekurhuleni Metro represents a cause for concern with regard to air pollution and health risk potentials. These fuels continue to be used for primarily two reasons: (i) rapid urbanisation and the growth of informal settlements has exacerbated backlogs in the distribution of basic services such as electricity and waste removal, and (ii) various electrified households continue to use coal due particularly to its cost effectiveness for space heating purposes and its multifunctional nature (supports cooking, heating

and lighting functions). Coal is relatively inexpensive and is easily accessible in Ekurhuleni due to the proximity of the region to coal mines and the well-developed local coal merchant industry.

Coal burning emits a large amount of gaseous and particulate pollutants including sulphur dioxide, heavy metals, and total and respirable particulates including heavy metals and inorganic ash, carbon monoxide, polycyclic aromatic hydrocarbons, and benzo (a) pyrene. Polyaromatic hydrocarbons are recognized as carcinogens. Pollutants arising due to the combustion of wood include respirable particulates, nitrogen dioxide, carbon monoxide, polycyclic aromatic hydrocarbons, particulate benzo(a)pyrene and formaldehyde. Particulate emissions from wood burning within South Africa have been found to contain about 50% elemental carbon and about 50% condensed hydrocarbons. The main pollutants emitted from the combustion of paraffin are NO_2, particulates, carbon monoxide and polycyclic aromatic hydrocarbons.

3.4 Transportation Systems

In the EMM transport-related emissions is of concern due to the relatively large distances travelled by commuters as a result of the spatial separation of work and residential areas. Towns within the EMM are linked by highways as well as national and provincial roadways of high standards. The Germiston Railway Centre is a major east-west and north-south rail interchange. During peak operation periods the Pretoria-Germiston rail link has a frequency of 25 trains per hour, while 829 bus trips carry approximately 37000 passengers over 560 routes per day in the morning peak periods. There are about 11 250 registered minibus taxis operating in the EMM area, providing transport for 335 000 passengers per day (Ekurhuleni 2003 State of Environment Report).

There are four major concentrations of historically disadvantaged communities situated on the outskirts of the activity nodes. These four areas are Tembisa, the Katorus complex (Katlehong, Tokoza and Vosloorus), the Kwatsaduza complex (Kwa - Thema, Tsakane and Duduza) and the Daveyton-Etwatwa complex. Informal settlements are concentrated mainly around these 4 complexes, although various informal settlements occur in an east-west band from the west of Germiston through to the east of Brakpan, and some to the south of Daveyton and surrounding Springs (Ekurhuleni 2003 State of Environment Report, SRK).

Priority issues that are of concern within the EMM related to the air quality implications of the transport sector include:

-Large-scale use of private vehicles
-poor public transport services
-need to expand metropolitan airports

Mass transport infrastructure has been reported to be losing market share to motor vehicle transport as well as commercial road transport (Ekurhuleni 2003 State of Environment Report). Cars remain the main mode of transport within the EMM, accounting for -53% of travel. The public transportation sector includes the use of rail (7.2%), minibus taxis (27.5) and buses (2.6%). Walking and cycling accounts for 9.2% of the model split. Urban sprawl and the location of residential settlements far from employment areas are responsible for long daily commutes.

3.4.1 Road Traffic

Ekurhuleni is linked to virtually all major destinations in the country by way of its freeway network, viz. R21 to Tshwane, N12 to Mpumalanga Province, N17 to Mpumalanga, N3 to Kwa-Zulu Natal and the R26 to the Free State. The east-west road infrastructure of Ekurhuleni is well developed. Ekurhuleni was reported to have approximately 8 300 km of roads in 2003, of which 6 700 km are tarred and the remaining 1 600 km are gravel roads. Although 10% of roads in Ekurhuleni experience high levels of congestion, overall there is less congestion in Ekurhuleni compared to that of the Greater Johannesburg and Tshwane (Ekurhuleni 2003 State of Environment Report).

Air pollution from vehicle emissions may be grouped into *primary* and *secondary* pollutants. Primary pollutants are those emitted directly into the atmosphere, and secondary, those pollutants formed in the atmosphere as a result of chemical reactions, such as hydrolysis, oxidation, or photochemical

reactions. The significant primary pollutants emitted by motor vehicle exhausts include CO_2, CO, HCs, SO_2, NO_X, particulates and lead. Secondary pollutants formed due to vehicle exhaust emissions include: NO_2, photochemical oxidants (e.g. ozone), HCs, sulphuric acid, sulphates, nitric acid, sulphates, nitric acid and nitrate aerosols.

3.4.2 Airports

There are three airports situated in Ekurhuleni, viz. the Johannesburg International Airport (JIA), the smaller Rand Airport and Dunnottar Airport situated in Germiston and Nigel respectively. In addition to these, Brakpan and Springs each have their own airfield. JIA, situated in the Northern SDR is the biggest airport in the country and the main international airport in South Africa. Dunnottar was previously a military airbase.

The main sources of emission associated with airport operations include: (i) vehicle tailpipe emissions from airport arrival-departure activities, airport ground-support services and airport access traffic routes, (ii) aircraft engine emissions during aircraft idling, taxing, takeoff and landing, (iii) auxiliary power units, and (iv) evaporative emissions during fuel handling and storage. Pollutants released include oxides of nitrogen, carbon monoxide, carbon dioxide, hydrocarbons, sulphur dioxide, lead, particulates, methane and various volatile organic compounds.

3.4.3 Railway Transport

Germiston Station is the convergence point of all main line networks of SA's railway infrastructure. The entire urban complex of Ekurhuleni is well serviced by rail infrastructure. From the Germiston Station, this rail network links the core activity areas to the disadvantaged communities. (Although the rail network forms the backbone of the public transport system in Ekurhuleni, over half of all work trips are made by private vehicle.) Trains in operation in Ekurhuleni include electric, steam and diesel-powered locomotives with the latter being prominent in the transportation of bulk materials to and from industrial sites.

Pollutants released from railway transport include carbon dioxide, carbon monoxide, volatile organic compounds, particulates, oxides of nitrogen, sulphur dioxide, methane, ammonia and lead. Parameters of importance in terms of the extent of emissions include: train types (diesel, steam, electric), average train speed, number of passengers per seat, topography of the distance travelled, slopes and hills, wind speed, number of cold starts (for diesel powered trains), average distance between train stations, and degree of reuse of braking energy.

3.5 Mining Operations and Tailings impoundments

There are four major concentrations of mines and quarries in Ekurhuleni, viz. (i) Reiger Park between Germiston and Boksburg, (ii) the area east of Benoni, (iii) an area east and south of springs, and (iv) three sites in the vicinity of Kwatsaduza. The first 3 areas are respectively known as the Germiston/Boksburg, the Benoni/Brakpan/Springs and the Springs/Nigel mining belts. Mining accounted for about 5% of the land use within Ekurhuleni during 2000 (Ekurhuleni 2003 SoE Report).

Little mining activity takes place in the Northern SDR aside from mining activities from the Southern and Eastern SDRs that encroach over the boundaries in the vicinity of Primrose CBD, as well as the land south of the Lilianton industrial area and at Rynfield/Morehill. Within the Eastern SDR mining activities still offer an economic base for at least the next five years, partly due to new mining techniques that made possible the mining of mine rich ore bodies through open cast methods. This mining option is being investigated in the area south of the N12-expressway in Benoni, from Snake Road to the Modderbee Prison. The mining of natural materials such as clay also takes place within the Eastern SDR, just east of the Vosterkroon industrial area. This mining has supported the establishment of three brick-making yards (Ekurhuleni 2003 SoE Report). Operational, abandoned and reclaimed mine dumps were noted by the 2003 Ekurhuleni State of Environment Report to be the most important dust sources. According to this report *"(t)he lack of enforcement of Environmental Management Program Reports (EMPRs) and other legal requirements results in the continuation of severe dust and water pollution emanating from slimes dams and derelict sand dumps"* (Ekurhuleni 2003 SoE Report).

Mines (both abandoned and operational) were identified through consulting the latest register of mines registered with the Department of Minerals & Energy (DME, 2001), records and maps of the Council for Geosciences, and a networking exercise amongst known mines. Three mining sub sectors were identified as being significant contributors to air pollution on the East Rand in general and more specifically within the Ekurhuleni Metropolitan Municipality. The sectors are as follows: (a) gold mining, (b) clay, fire clay and shale mining, and (c) gravel and aggregate mining sub sectors. A total number of some 86 mines were identified in the Ekurhuleni Metro, of which 21 mines are operational. The majority of the remaining mines are abandoned underground gold mines and which are lying derelict.

Over the last 25 years a favourable gold price (and in particular a favourable Rand price of gold), together with improvements in extraction technology (e.g. the carbon in leach and carbon in resin process) made it possible for many mine tailings and certain slimes dams to be reprocessed in order to extract residual gold. Tailings reclamation operations are presently operated by Ergo, Crown and ERPM, with large reclamation operations being run being Ergo and Crown mines. However, due the strengthening of the rand of late has made the reclamation of most tailings dumps unfeasible and Ergo is reportedly winding up its reclamation operations and is scheduled to close all processing down by March 2005. It is reported that the current reclamation of tailings and slimes dams is reducing the number of dams by 30% to 38% and the total surface area of the tailings by between 41% and 48%.

3.6 Waste Disposal and Treatment Options

Waste treatment and disposal methods in the EMM which are of interest in terms of the toxicity and odiferous nature of their emissions include: incineration, land filling, and liquid waste ponds used for the treatment, storage and disposal of liquid wastes.

3.6.1 Landfill Operations

The solid waste management annual report for Ekurhuleni (2003) as sited in the Ekurhuleni 2003 State of Environment Report indicates a total general waste disposal to landfill from industrial and domestic waste as 1.235 million tons per year. This is equivalent to a per capital production rate of 0.35 tones per annum. It is notable that ash and soils constitute about 84% of the waste stream due to the prevalence of these waste types within the waste from the informal sector and previously disadvantaged communities.

The majority of the waste collected by the local authority is disposed to landfill, usually within 1-0-20 km radius of the residential areas within which the waste was generated. At present, EMM has six regional disposal facilities under its jurisdiction, viz.: Zestfontein (proposed, Boksburg), Weltevreden (Brakpan), Simmer & Jack and Rooikraal (Germiston), Rietfontein (Springs) and Platkop (Heidelberg, not within EMM). The formal waste sites within Ekurhuleni are permitted, and operated, in accordance with the minimum requirements of DWAF.

Table 1. Landfill operations within the EMM, including municipal and private sites

Responsibility	Name	Classification	Lifespan Available (Years)	Status
Municipal landfill sites	Platkop (Heildelburg, not within EMM)	GLB-	47	Operational
	Simmer & Jack (Germiston)	GLB-	5-10	Operational
	Weltevreden (Brakpan)	GLB-	42	Operational
	Rietfontein (Springs)	GLB+	20-38	Operational
	Rooikraal (Germiston)	GLB (applied for)	38	Operational
	Zestfontein (proposed, Boksburg)			Proposed
Enviroserv (Dispose-tech)	Holfontein	H:H	35	Operational
	Chloorkop (Kempton Park)	H:h		Operational
Sappi Enstra	Sappi Enstra (Springs)			Operational
Scaw Metals	Scaw Metals			Operational

Closed sites	Alberton (Verwoerdpark)	GMB-		Closed (?)
	Nigel	GMB-		Closed (?)
	Nuffield (Springs)	GLB+		Closed
	Mooifontein (Kempton Park Mun.)	GMB-		Closed (?)
	Tembisa	GMB-		Closed (?)

The municipal waste sites in Ekurhuleni are permitted General Waste sites, although Platkop and Weltevreden can receive some specified hazardous waste. It is also recognized that some domestic and industrial/commercial hazardous waste may be co-disposed with general waste, due to the limited capacity to segregate such waste during disposal. For example, it is estimated that about 2 000 tap of asbestos waste, which is classifiable as hazardous, is co-disposed to Platkop, and approximately 20 000 tap of paper pulp to Weltevreden waste site (Ekurhuleni 2003 State of Environment Report).

Limited information is available on the practical volumes and quantities of hazardous waste disposed of to landfill sites in Ekurhuleni, or on the volumes and masses of hazardous waste stored on-site by industrial, power generation and mining operations. Holfontein waste disposal facility, operated by Enviroserv Holdings, is the primary hazardous waste (H:H) site in Gauteng. This site receives waste nationally. Approximately 240 000 TPA of hazardous waste is reported to be received by Holfontein (Ekurhuleni 2003 State of Environment Report). Previously, hazardous waste was also received by Nuffield waste disposal site (located southeast of Springs) but, subsequent to the closure of this site, the hazardous wastes are being sent to Holfontein.

The Chloorkop waste disposal site is also located within the EMM. Although privately owned, the Kempton Park and Edenvale service delivery centres are reported to be disposing waste there (Ekurhuleni 2003 State of Environment Report). Industrial waste disposal sites include sites operated by Scaw Metals (southeast of Alberton) and Sappi Enstra (northeast of springs).

Within Ekurhuleni there is no formalized comprehensive system or service for recycling. It is estimated that approximately 50% of the general waste currently being disposed of on landfills has the potential to be recovered for recycling or re-use, thus being diverted out of the waste stream (specifically paper, glass, beverage cans and metal) (Ekurhuleni 2003 State of Environment Report). Informal waste disposal sites (dumps) have arisen due to the dense informal settlements areas that have developed. Problem areas have been identified in Tembisa, Katlehong, Takoza and, Kwa-Thema but the problem is common to most dense settlements (Ekurhuleni 2003 State of Environment Report).

Landfill gases of concern associated with the general or co-disposal landfill options include a range of odiferous and toxic gases. Landfill gas usually contains between 40% and 60% methane and similar percentages of carbon dioxide. Other gases constitute only a small fraction of the total gas, and include both inorganic products and a large number of organic compounds. Studies indicate that over 200 compounds can be encountered in a landfill site. Odorous substances most frequently considered in local air quality impact assessment studies for such operations include hydrogen sulphide, butyric acid and limonene. High concentrations of amine constituents have also been observed to be responsible for odour impacts of various local landfills. Carcinogenic substances frequently measured at waste disposal sites include methylene chloride and benzene.

Air quality impact assessment conducted for large hazardous and general landfill sites in South Africa (including the Chloorkop, Holfontein and the closed Margolis waste sites) have generally indicated that:
-significant health risks, given good landfill facility management, are restricted to within 500 m of the landfill boundary;
-odour impact distances can vary from 200 m to 5 km depending on facility management; and
-nuisance dust impacts are generally restricted to within the immediate boundary of the facility.
Given the range of pollutants emitted from landfill operations (and the difficulties in controlling emissions at sites with histories of poor management) it is recommended that landfill sites be classified as possible

"toxic hotspots" for air quality management purposes.

3.6.2 Incinerator Operations

Incineration became a Scheduled Process in October 1994. Permit requirements for such operations include operating temperature, combustion retention time and emission standard stipulations. Since March 1998, Environmental Impact Assessments have been required to be completed for proposed incinerator operations.

Heavy metal, dioxin and furan emissions from waste incineration represent a considerable air quality and health risk concern related to such operations. Particuiate emissions from incinerators may also comprise heavy metals such as chromium and cadmium, which are suspected human carcinogens. Incinerators have however to date represented the only viable alternative for the dispose of all medical wastes. (New methods currently under development include plasma converter technologies.)

Data on the volumes of health case wastes are limited. Based on the number of hospital beds, and the average waste generation rate of 1.95 kg/beg/day Ekurhuleni could be expected to produce a significant volume of medical waste requiring incineration and safe disposal.

Information on incinerator operations, obtained in October 2000, from the Gauteng Department of Agriculture, Conservation, Environment and Land Affairs (GDACE) are presented in Table 2. According to these data there were 11 facilities operating a total of 13 incinerators at the end of 2000. None of these incinerators were reported to have scrubbing equipment installed to restrict emissions. Certain of the operations were flagged as being of concern in terms of equipment being old or in a poor state of repair. More current data on incinerator operations could not be obtained from GDACE, DEAT or Ekurhuleni.

Table 2. Operative status and incinerator capacity of incineration operations within the EMM (as at October 2000)

Local Authority	Facility Name	Operative Status	Incinerator Capacity (t/month)	Actual Waste Incinerated (kg/month)	FLAGS[4]
Benoni	Actonville Hospital	Yes	27	3000	
	Glynnwood Hospital	Yes	27	3000	
Boksburg	3oksburg Prison	Yes	9	150	
	ERPM Hospital	No			X
	Tambo Memorial	No	64	400	
	Tambo Memorial	No	64		
Edenvale	Edenvale General	Yes	27	540	
Germiston	Enviroserv Rietfontein	Yes	200	100000	
	Enviroserv Rietfontein	Yes	200		
	Germiston	Yes	27	1000	X
Katlehong	Natalspruit	Yes	18	990	X
Kempton Park	Arwyp Medical Centre	Yes	9		X
Nigel	Nigel Hospital	Yes	18	50	
Olifantsfontein	Tembisa Hospital	No	64	500	
	Tembisa Hospital	No	64		
Springs	Far East Rand	Yes	27	10500	X
	Pholosong Hospital	Yes	82	200	
	Pholosong Hospital	Yes	82		

The emission rates of incinerator operations are a function of fuel usage, waste composition, incinerator design characteristics and operating conditions. Incinerator emissions from emissions from incinerators may be grouped into: criteria gases (sulphur dioxide, oxides of nitrogen, carbon

[4]Incinerators noted to be old, in a poor state of repair and/or not operating efficiently are indicated (as at October 2000).

monoxide, lead and particulates), acid gases (hydrogen chloride, hydrogen bromide, and hydrogen fluoride), metals (chromium, arsenic, cadmium, mercury, manganese, etc.) and dioxins and furans - (such as polychlorinated dibenzo-p-dioxins and dibenzo furans). Given the range of pollutants emitted from incinerator operations and the toxic nature of several of such pollutants, it is recommended that incinerators be identified as potential "toxic hotspots" for air quality management needs purposes. Incinerator emissions have a greater sphere of influence than do landfills and waste water treatment plants due to the elevated nature of the emission and the larger quantities being released.

3.6.3 Waste Water Treatment Works

Given the DWAF Baseline Study (as sited in the Ekurhuleni 2003 SoE Report) projected sludge production rate of 50 g/person/day, Ekurhuleni could be expected to produce in the order of about 175 tons of day sludge per day. Ekurhuleni has a number of sewage treatment plants of its own. These sites are operated under contract by a section 21 company, the East Rand Water Care Company (ERWAT). It is reported by the East Rand Water Care Company (ERWAT) that Ekurhuleni has 18 wastewater treatment plants.

The potential for emissions of volatile organic compounds (VOCs) during wastewater treatment is a cause for concern. Species measured at local waste water treatment works have included: hydrogen sulphide, mercaptans, ammonia, formaldehyde, acetone, toluene, ethyl benzene, xylenes, perchloroethylene, butyric acid, propionic acid, valeric acid and acetic acid. Species that generally represent the most important odorants include: hydrogen sulphide, mercaptans, ammonia, and the various fatty acids (butyric, propionic, valeric, and acetic).

4. PRIORITY SOURCES, POLLUTANTS AND AREAS

4.1 Priority Air Pollutants

Pollutants that have been measured to exceed guideline values within the EMM include PM10 (particulate matter less than 10 microns in aerodynamic diameter), sulphur dioxide and nitrogen dioxide. Sites at which such exceedances have been *measured*[5] to occur are as follows:

Nitrogen dioxide	Esterpark
Particulates	Esterpark, Boksburg (various sites - Etwatwa, Boksburg East, Reiger Park, Vosloorus, Villa Liza), Brakpan, Springs (various sites - CBD, New Era, Nuffield, Thebelisha, White City), Tembisa and Ivory Park
Sulphur dioxide	Esterpark, Boksburg (Cinderella, Boksburg East, Vosloorus), Brakpan (Leachville), Springs (various sites - CBD, New Era, Nuffield, Thebelisha, White City, Dr WK du Plessis School), Tembisa and Ivory Park

Based on monitoring campaigns conducted within Ekurhuleni and in similar local urban areas, benzene and ozone have been noted to exceed health guidelines. Benzene thresholds are typically exceeded in close proximity to busy highways and intersections and at large filling stations. Ozone, which is formed in the atmosphere through the conversion of

Volatile organic compounds and oxides of nitrogen, is typically elevated downwind of urban areas.

4.2 Significant Sources of Atmospheric Emissions

Sources of emission identified as occurring within the EMM are summarised in Table 3. The

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 Only sites at which exceedances were monitored to have been exceeded are listed in the table. It is noted that guideline exceedances is likely do occur at various other locations within the EMM at which monitoring has not been conducted.

significance of transboundary sources through their contribution to the regional aerosol component is noted in the table despite such sources not being located within the region. Pollutants released by each source are indicated.

Table 3. Sources of atmospheric emissions within Ekurhuleni and their associated emissions

Sources	PM	SO_2	NO_X	CO	CO2	CH4	HAPs
Vehicle-tailpipe emissions	x	x	x	x	x	x	x
Industrial operations, energy generation and commercial fuel burning appliances	x	x	x	x	x	x	x
Domestic fuel burning	x	x	x	x	x	x	x
Ayiation emissions	x	x	x	x	x	x	x
Landfills	x				x	x	x
Incineration	x	x	x	x	x	x	x
Vehicle-entrainment of road dust	x						
Biomass burning	x	x	x	x	x	x	x
Mining activities	x						
Agricultural activities	x						
Tyre burning	x	x	x	x	x	x	x
Wind-blown dust from open areas	x						
Regional aerosol (from distant sources)	x						

HAP - hazardous air pollutants (includes toxins and carcinogens)
x - indicates pollutant is emitted by particular source type

Emissions from industrial processes and industrial/commercial/institutional fuel burning contribute most significantly to TSP, PM10 and SO_2 emissions. This sector also contributes to NO_X and to greenhouse gas emissions (CO_2, N_2O). Vehicle emissions are the most significant source of NO_X, CO, TOC, NMTOC, benzene, formaldehyde, acetaldehyde, lead and 1.3 butadiene emissions. Vehicle emissions also contribute significantly to greenhouse gas emissions (CO_2, CH_4 but particularly N_2O) and contribute -30% of fine particulate emissions and -20% of the SO_2 emissions.

Domestic fuel burning represents a significant source of fine particulates and also contributes to greenhouse gas emissions (CO_2 and CH_4).- Despite the relatively small emissions from domestic fuel burning, compared with industry, the significance of domestic fuel burning emissions is enhance due to the low level at which emissions occur, the peaks in emissions and the proximity of releases to high exposure areas.

Biomass burning contributes to fine particulate and methane emissions, representing a potentially important localised source of episodic emissions in Ekurhuleni. Although airport emissions contribute marginally to total NO_X emissions, it is important as a concentrated source of predominantly low-level emissions.

Wind blown dust from mine tailings and slimes dams are expected to contribute significantly to airborne loadings of fine particulate concentrations. First approximations' of current PM10 emissions from this source indicate that the source could contribute -25% of the primary particulate emissions quantified during the study. Given the proposed reduction in the number of dams by 41%, PM10 emissions could reduce by -60% given the extent of the

Remaining dams. The potential however exists for significant impacts to occur during the dam removal/remaining period.
The extent of primary emissions is not a concise indicator of contribution to ground level air pollutant concentrations and health and environmental risks. The reasons for this are as follows:

- Ambient air pollutant concentrations and associated impacts depend not only on the extent of emissions but also on the height of emissions and the distance between the source and sensitive receptors.
- Contributions to primary emissions do not reflect contributions to the formation of secondary pollutants in the atmosphere. Sources emitting sulphur dioxide and NO_X, for example, also contribute to particulate matter in the atmosphere due to the conversion of these gaseous

pollutants to sulphates and nitrates. Similarly source contributions to ambient concentrations of photochemical-induced pollutants, such as ozone, are not quantified.

Sources that have been found to be significant in terms of their contributions to *ambient air pollutant concentrations and associated health risks* include:

-Household fuel burning - particularly coal and, to a lesser extent, wood burning. Household fuel burning is predicted to be a very significant contributor to fine particulate concentrations within densely populated areas.
-Industrial and commercial fuel burning - particularly uncontrolled coal-fired boilers in close proximity to residential area. These sources contribute significantly to ambient sulphur dioxide and PM10 concentrations.
-Vehicle exhaust emissions - including both petrol and diesel vehicle emissions. Road traffic is the most significant source of NO_X, CO and VOC emissions and is anticipated to contribute significantly to ozone formation. (NO_X and VOCs are both important precursors of photochemical products.)
-Johannesburg International Airport - despite contributing only a small fraction of the total emissions, the airport is a significant source of low level, concentrated NO_X emissions. The airport is anticipated to contribute to NO_2 health threshold exceedances in the vicinity of the airport.
-Unrehabilitated mine tailings impoundments - significant source of nuisance dust fall and potentially contribute significantly to airborne concentrations of fine particulates.
-Large industries associated with various stack, vent and fugitive emissions - not adequately quantified during the current study due to the unavailability of current and comprehensive source and emissions data for such operations.

4.3 Potential Impact Areas

Areas within Ekurhuleni associated with elevated air pollutant concentrations and the potential for health and/or environmental risks were identified as including:

-Household fuel burning areas - due to high particulate concentrations associated with fuel burning for cooking and heating purposes;
-Central business district and residential areas transected by highways, on-ramps and main feeder roads;
-Residential areas in close proximity to industrial areas such as Olifantsfontein, Clayville, Isanda, Wadeville, Alrode, Benoni South and Apex industrial areas, and Springs industrial areas such as Nuffield and New Era;

-Residential areas in close proximity to Johannesburg International Airport; and

-Residential areas near uncontrolled mine tailings impoundments.

4.4 Synopsis of Priority Pollutants, Sources and Areas

A synopsis of pollutants, contributing sources and key impacts areas is presented in Table 4.

Table 4. Summary of priority pollutants, areas and sources of emission within Ekurhuleni Metropolitan municipality

Pollutants	Main Contributing Sources	Key impacted Areas
PM10, PM2.5	-Household fuel combustion (notable given high exposures) -Transport (primarily diesel vehicle emissions) -Industrial (including process emissions, fugitive dust and fuel combustion products) -Vehicle entrapment from unpaved roads -Other sources (primarily wild fires, agricultural activities, tyre burning significant in terms of episodes)	Elevated concentrations over much of the EMM resulting in widespread health risks, with significant health effects anticipated in residential fuel burning areas (e.g. Tembisa, Etwatwa).
NO_2	-Transport (petrol vehicles, diesel vehicles then airport activities) -Industrial processes -Household fuel combustion -Wild fires, tyre burning, etc. as minor sources	Notably elevated concentrations (health threshold exceedances) in close proximity to busy roadways
Ozone	-Secondary pollutant associated with NO_X and volatile organic compound releases -Transport (petrol vehicles as key contributor, also diesel. vehicles, airport activities) -Household fuel combustion -Industrial processes -Wildfires	Anticipated to be elevated across the metro, particularly downwind of major sources of precursor pollutants (i.e. NO* and volatile organic compounds). Monitoring is required to confirm ozone levels.
SO_2	-Industrial and non-domestic fuel burning sector (particularly due to coal and to a much lesser extent HFO combustion) -Transport (diesel vehicles, petrol vehicles) -Household fuel combustion -Tyre burning, wild fires	Large spatial variations in concentrations anticipated. Guideline exceedances noted in close proximity to heavy industrial areas. Monitoring within household coal burning areas required to determine potential for health threshold exceedances.
VOCs	-Transport (petrol vehicles as key contributor, also diesel vehicles, airport activities) -Industrial processes (including stack emissions and diffuse sources such as evaporative emissions from chemical storage) -Household fuel combustion - Wildfires	Main impact zones should be established following additional monitoring and modelling efforts
CO	-Transport -Industrial processes -Household fuel combustion -Wild fires, tyre burning	Notably elevated concentrations (possible non-compliance events) near busy roadways
Air Toxics	Incinerators, landfill operations, waste water treatment works, specific industries (refinery, pulp and paper manufacturing, printers, dyers, etc.)	In close vicinity to sources
Total Suspended Particulates (TSP)	Dust sources currently significantly impacting on the well-being of a large number of persons: -unrehabilitated or partially rehabilitated mine tailings impoundments -unpaved roads where traffic volumes are high Other more minor (in terms of the number of persons impacted) or intermittent sources: -insufficiently mitigated mining operations -large-scale, poorly mitigated construction operations -boiler operations (soiling potential) -exposed soil areas (Aug - Sep months) and agricultural activities (ploughing seasons)	Residential and commercial areas located in close proximity to: unrehabilitated or partially rehabilitated mine tailings impoundments, busy unpaved roads, poorly mitigated mining, agricultural and construction operations.

5. HUMAN HEALTH RISKS AND COSTS DUE TO FUEL BURNING EMISSIONS

5.1 Human Health Risk Quantification

Human health impacts due to fuel usage and inhalation exposures to fuel burning emissions were predicted for Ekurhuleni Metro and the City of Joburg combined during the NEDLAC "Dirty Fuels" Study (Scorgie *et* a/., 2004). These regions were combined due to the potential for sources emitting within Ekurhuleni to impact on the population of Joburg and visa versa. The study also included the costing, in monetary terms, of direct health spending occurring as a result of such impacts.

The extent of health impacts arising due to fuel combustion related air emissions was established through the application of *dose-response relationships.* Dose-response relationships provide the link between exposures to ambient air pollutant concentrations and the resultant health outcomes. Given the absence of locally generated relationships it was necessary to make reference to the international literature to identify dose-response functions that are applicable to South Africa. Although emissions were initially quantified for a wide array of pollutants, the quantification and costing of inhalation exposures were restricted to the following pollutants due to the availability of applicable dose-response functions and cost data for resultant health effects: PM10, SO_2, NO_2, benzene, 1.3 butadiene and formaldehyde. Although lead-related health impacts were originally also quantified such impacts (e.g. IQ deficits) could not be costed in monetary terms.

Dose-response relationships for PM10, SO_2 and NO_2 exposures are typically expressed for ailments related to the human respiratory function. Health endpoints considered included respiratory hospital admissions and incidences of chronic bronchitis and asthma. Exposures to benzene, 1.3 butadiene and formaldehyde were quantified in terms of their being carcinogens.

Total respiratory hospital admissions, premature mortalities, excess cancer cases and restricted activity rates predicted due to exposures fuel combustion related emissions for the year 2002 are summarised in Table 5. In interpreting the information presented it must be noted that not all industrial, institutional and commercial fuel burning operations were accounted for in the NEDLAC study (e.g. emission estimates for less than 10% of the small scale boiler operations were included.) It is also imperative to note that the NEDLAC study Focused on fuel burning emissions. Industrial (non-fuel burning related) process emissions were therefore not taken into account. The inhalation exposures and resultant health risks are therefore not representative of total emissions from the industrial sector.

Table 5 Health impacts, given as number of cases or incidences, associated with human exposures to fuel burning emissions predicted for the base year 2002(a)

HEALTH ENDPOINT	INCIDENCE/YEAR
Respiratory hospital admissions (due to PM10, SO2 and NO2 exposures)	34,021.1
Cardiovascular hospital admissions (due to PM10 exposures)	262.2
Premature mortality ^due to PM10 and SO2 exposures)	71.5
Chronic bronchitis (due to PM10 exposures)	38.550.4
Restricted activity days (RAD, due to PM10 exposures)	238,326.3
Leukemia cases (due to 1.3 butadiene and benzene exposures)	67.4
Nasal carcinoma cases (due to formaldehyde exposures)	1.5
Number of children exposed to > 2ug/m^3 of lead & hence to potential for IQ point reductions	5,285.8

(a) Exposures to photochemical products such as ozone and exposures to indoor pollutant concentrations are not accounted for.

Domestic fuel burning was found to represent the most significant source of respiratory hospital admissions and premature mortalities, estimated to account for 77% and 84% of such cases respectively (56% and 61% due to coal burning, remainder due to wood burning). Vehicle emissions were associated with 12% of the risks of respiratory hospitalizations (7% due to diesel vehicles). Coal fired boilers combined were estimated to be responsible for 7% of all respiratory hospitalizations and premature mortality, with the coal boiler operations at NCP, Zwartkoppies pump

station and Sappi Enstra estimated to account for 1%, 0.6% and 0.5% of respiratory hospital admissions respectively. Kelvin Power Station was calculated to be responsible for -0.7% of cases due to inhalation exposures to fuel burning emissions.

Domestic fuel burning was estimated to be responsible for 3.6 excess leukaemia cases, with vehicle related emissions predicted to account for a further 64 cases. Emissions from petrol-driven vehicles were estimated to result in -5300 children being exposed to lead concentrations in excess of 2 ug/m^3 which represents the threshold above which IQ point deficits have been noted to occur.
Assuming 'business as usual' it was estimated that health effects due to exposures to ambient pollutant concentrations resulting from burning emissions will increase during the next decade in the range of 4% to 21 %.

5.2 Monetary Costing of Health Risks

Following the quantification of health impacts due to current fuel use practices, such health impacts were costed in monetary terms in order to provide an estimate of damages. Reference was made to health cost data from the Med Scheme database to cost air pollution inhalation, paraffin-ingestion and burn related health impacts. Total direct health costs related to fuel usage and inhalation exposures to fuel burning emissions were estimated to be in the order of 1.3 billion 2002 rand per annum across health effects and source groupings. Respiratory illnesses due to inhalation exposures to fuel burning emissions accounted for 77% of these costs.

5.3 Implications for Air Pollution Control

The conclusion reached was that the relationship between emissions and resultant health costs due to inhalation related health effects varies significantly between source groupings. The reason being that the human health impact of a source is dependent not only on the extent of its emissions but also on a number of other factors. Such factors include: type of pollutant released, height of release, proximity of source to areas with high human exposure potentials, duration and frequency of emissions (etc.).

Although domestic fuel burning is estimated to have contributed only -7% of the emissions, it was predicted to account for 76% of the health costs due to inhalation-related health effects. The health impact potential of domestic fuel burning emissions is enhanced due to three factors: (i) the low level of emissions, (ii) the coincidence of peak emissions, typically a factor of 10 greater than it total annual emissions were averaged, with periods of poor atmospheric dispersion (i.e. night-time, winter-time), and (iii) the release of such emissions within high human exposure areas.

Minor emission reductions within the domestic fuel burning sector would result in relatively significant reductions in direct health spending. Substantial emission reductions would need to be realized within the power generation sector to achieve equivalent decreases in health spending. This indicates that the most cost-effective interventions are likely to be within the domestic fuel burning sector. The potential however also exists for cost-effectively off-setting of interventions within the industrial and commercial fuel burning sectors if such interventions were specifically targeted at uncontrolled or poorly controlled operations located in close proximity to sensitive receptors.

6. LEGISLATIVE FRAMEWORK

Prior to assessing current and possible future air pollution control and air quality management practices within the Ekurhuleni Metro it is imperative to consider the legislative and regulatory context within which such practices occur.

6.1 Current Air Pollution Legislative Context - Air Pollution Prevention Act 45 of 1965

Air pollution control is administered at a national level by the Department of Environmental Affairs and Tourism according to the Atmospheric Pollution Prevention Act No. 45 of 1965 as amended. The Department of Environmental Affairs and Tourism is responsible for the administration of this Act.

The Air Pollution Prevention Act regulates the control of noxious and offensive gases emitted by industrial processes, the control of smoke and wind borne dust pollution, and emissions from diesel vehicles. The implementation of the act is charged to the Chief Air Pollution Control Officer (CAPCO).

All industries undertaking scheduled processes are controlled by CAPCO through Best Practicable Means (BPM) using permits. Scheduled processes, referred to in the Act, are processes which emit more than a defined quantity of pollutants per year. Such processes include large combustion sources, smelting and inherently dusty industries. BPM represents an attempt to restrict emissions while having regard to local conditions, the prevailing extent of technical knowledge, the available control options, and the cost of abatement.

Although emission limits and ambient concentration guidelines are published by the Department of Environmental Affairs and Tourism (DEAT), no provision is made in the current legislation for ambient air quality standards or emission standards. The decision as to what constitutes the best practicable means for each individual case is reached following discussions with the industry. A registration certificate, containing maximum emission limits specific to the industry, is then issued.

CAPCO is responsible for the control of dust from industry and waste dumps. Dust control from mine dumps is the result of consultation between the Government Mining Engineer and CAPCO. The control of dust is undertaken using BPM through notice in writing. Powers for dust control have selectively been delegated to local authorities.

With the exception of the provisions relating to noxious and offensive gases, and dust the administration and enforcement of the air pollution prevention measures imposed by the Atmospheric Pollution Prevention Act of 1965 are entrusted to local authorities by virtue of the fact that measures relating to smoke and vehicle emissions apply only in areas in which the Minister of Environmental Affairs (by notice in the *Government Gazette)* declared them to be applicable. These notices also delegated the responsibility to administer and enforce the pollution prevention measures to local authorities.

The current obligations imposed by Act on local authorities are briefly listed.

Section 15: Approval of the installation of fuel burning appliances in areas where Part II has been declared to apply (installations in dwelling houses expressly being excluded);

Section 16: Criteria that must be satisfied prior to the approval of the installation of fuel burning appliances;

Section 17: Obligation on local authority to serve notice on person responsible for a nuisance situation caused by smoke or any other product of combustion;

Section 18 enables local authorities to promulgate smoke control regulations. Several smoke control regulations have been promulgated in terms of this section by municipalities that now form part of the EMM. These regulations are all very similar in content and typically -

- prohibit the use of waste incinerators other than appliances that are approved in writing by the council;
- impose a smoke density limit linked to the chart shown in the first schedule to the Act (based either on visual observation or measured with a light absorption meter).

(In terms of section 57 of the proposed Air Quality Bill, these regulations will remain in force until specifically repealed by the municipality of the area concerned. It is therefore important to consider the continued relevance of these by-laws as part of the development of the AQM Plan. If no longer appropriate, it will be necessary to specifically repeal the bylaws.)

Section 30: Enables the Minister of Environmental Affairs to direct local authorities to take certain measures to address dust pollution instances where special circumstances exist.

Section 36(2): Delegates the administration and enforcement of measures aimed at controlling

fumes emitted by vehicles to local authorities. Emission limits and areas of application are set out in GN R 1651 of 20 September 1974 (including several of the EMM areas e.g. Alberton, Benoni, Boksburg, Brakpan, Edenvale, Germiston, Springs etc). As mentioned above, in terms of section 57 of the proposed Air Quality. Bill, these regulations will remain in force until specifically repealed by the municipality of the area concerned. It is therefore important to consider the continued relevance of these by-laws as part of the development of the AQM Plan. If no longer appropriate, it will be necessary to specifically repeal the regulations.

It is evident that air pollution management in South Africa is currently based entirely on source-based controls, and is focused primarily on controlling the emissions from the industrial sector. Proposed industries are permitted to go ahead if compliance with emissions limits set by CAPCO is demonstrated. Such emission limits imposed by the Chief Officer reflect the prevailing extent of technical knowledge, and the availability of control options which do not exceed "excessive costs", rather than measures to ensure the maintenance of acceptable air quality.

6.2 National Environmental Management: Air Quality Act - Introducing a New Approach to Air Quality Management

The Atmospheric Pollution Prevention Act of 1965 is not adequate to facilitate the implementation of the principles underpinning the National Environmental Management Act (NEMA) and the Integrated Pollution and Waste Management (IP&WM) white paper. This Act is also out of line with what is international considered to represent good air quality management practice. The current revision of this Act as part of the Law Reform Process will reflect the overarching principles within general environmental policy and will bring legislation in line with local and international air quality management practices. The approach to be supported by the new legislation is outline below.

A shift from *national air pollution control based on source-based controls* to *decentralized air quality management through an effects-based approach* is supported by the new legislation. (The management of urban air quality by local government using a uniform set of national air quality standards has been practiced in the USA for almost two decades, and has recently been introduced in the United Kingdom. The experience of such countries provides valuable information on sound directions for future South African legislation and its implementation.)

An **effects-based approach** requires the setting of **multiple levels of standards** for ambient air quality. Ambient standards that define satisfactory air quality to ensure human health and welfare, the protection of the natural and build environment, and finally the prevention of significant decline in the quality of air are needed. Such standards provide the *objectives* for air quality management. Multiple levels of standards provide the basis for both 'continued improvements' in air quality and for long-term planning in air quality management. Although maximum levels of ambient concentrations should be set at a national level, more stringent ambient standards may be implemented by provincial and metropolitan authorities.

Source-based controls, including BPM and best available technology not entailing excessive cost (BATNEEC), can not ensure air quality but rather represents **one** means of achieving and attaining ambient standards. Alternative regulatory approaches which need be investigated during the design of programmes aimed at the attainment and maintenance of ambient standards include: **pro-active controls, market-incentives, self-regulation** and **community-based initiatives.** The integration of diverse emission reduction approaches will ensure innovative and flexible policies and plans of action tailored to suit local circumstances.

The **control and management of all sources of air pollution relative to their contributions** to ambient concentrations is required to ensure that improvements in air quality are secured in the most timely, even-handed and cost-effective way. (This implies that legislation for the regulation of all significant sources need be put in place, effective management structures developed, inventive and flexible strategies devised, and sufficient resources allocated.)

Public participation in the air quality management process and **public access to information,**

including information on environmentally harmful practices will be a crucial component of future legislation. It is recognised that the integration of public participation into the decision-making process will be enhanced through education and awareness programmes aimed at the empowerment of communities.

Provision will be made for the integration **of** air quality issues **into** the **transportation,** housing **and land use planning processes** in order to ensure that air quality issues are, addressed in the long term.

The **decentralisation** of air quality management will enable management strategies aimed at securing ambient standards to be geared towards local environments. Decentralized air quality management is also more conducive to effective public participation in the management process. In decentralized air quality management, caution will need to be exercised to ensure a basis for effective air quality management, in terms of expertise, funds, and the consistent implementation of tools.

6.2.1 Enabling Legislation for Local Government

The decentralization of AQM and associated new responsibilities for local government is made feasible given the recent promulgation of enabling legislation for local government. The Municipal Structures Act, together with the Local Government: Municipal Systems Act 32 of 2000, have firmly established Local Government as an autonomous sphere of government having specific functions defined by the Constitution.
The Access to Information Act, 95 of 2000 aims to promote transparency, accountability and elective governance of all public and private bodies through educating everyone to effectively scrutinize, and participate in, decision-making by public bodies that affect their rights. The Promotion of Administrative Justice Act, 96 of 2000 aims to give effect to section 33 of the Constitution. In terms of this Act, local government can be held responsible for its actions and decisions by the public and is required to act in an efficient and transparent manner. New responsibilities for local government arising due to recent legislative changes include facilitation of public participation, transparency, accountability and access to information.

According to Section 156(1) of the Constitution a municipality has the executive authority in respect of, and has the right to administer the local government matters listed in, Part B of Schedule 4 of the constitution that deals with air pollution. Section 156(2) makes provision for a municipality to make and administer by-laws for the effective administration of the matters which it has the right to administer so long as such by-laws do not conflict with national or provincial legislation. The repealing of Local Government Transition Act, Act no. 209 of 1993 on 5 December 2000 removed legislative obstacles to the application of Section 156 of the Constitution by municipalities. In response to this, the City of Johannesburg is able to pass by-laws dealing with local air pollution control.

6.2.2 Delineation of National, Provincial and Local Government Responsibilities

In accordance with the IP&WM Policy, the DEAT indicates that it will delegate the responsibility for air quality management strategy implementation and regulation enforcement to the *'appropriate sphere of government'.*

The anticipated delineation of responsibilities between national, provincial and local government, as informed by the Air Quality Bill, are outline in Table 6. National Government is tasked with the enforcement of the national AQM legislative framework with provincial and local government being required to operate within this framework. Provincial government is permitted to develop their own legislation and policies to meet their obligations in terms of the national policy. Local government are permitted to develop and implement local AQM programmes, guidelines and by-laws in line with national and provincial policy and legislation.

Table 6. Proposed national, provincial and local government functions as informed by the Air Quality Bill

NATIONAL Government Functions and Responsibilities	PROVINCIAL Government Functions and Responsibilities	LOCAL Government Functions and Responsibilities
Establish & review national framework	Air quality monitoring	Air quality monitoring
Identify priority pollutants	monitor municipality performance	Emission monitoring
Establish national air quality standards	Identify priority pollutants	Identify priority pollutants
Establish national emission standards	Establish provincial air quality standards	Establish local emission standards
Appoint national AQ officer	Establish provincial emission standards	Appoint AQ officer
Integrate AQM plans into their Environmental Management Plans	Appoint provincial AQ officer	Develop and implement AQM plan as Dart of their Integrated Development Plans (IDP)
Declare priority areas	Integrate AQM plans into their Environmental Management Plans	Collaborate with national & provincial government (within priority areas)
Prepare priority areas AQMP	Declare priority areas	Perform emission licensing authority functions (metros and district municipalities)
List activities	Prepare priority areas AQMP	
Declare controlled emitters	List activities	
Set requirements for PPP	Declare controlled emitters	
Set regulations for dust, odour, noise	(Perform emission licensing authority functions if no capacity by local authorities)	
Investigate & regulate transboundary pollution		
Investigate potential international agreement contraventions		

7. EXISTING AIR QUALITY MANAGEMENT PRACTICES AND SKILLS WITHIN EMM

Two departments are currently engaged in air pollution control and air quality management functions, viz. the Department of Environment and Tourism and the Department of Health and Social Development. Although the Department of Environment and Tourism has recently been designated the lead agency with regard to air quality management, the Department of Health and Social Development has historically been responsible for the implementation of air pollution controls. An Integrated Pollution Control (IPC) unit has been established within the Environmental Health Division of the Department of Health and Social Development to assist in fulfilling the current air pollution control functions of the municipality under the Atmospheric Pollution Prevention Act.

Information on several of the functions pertaining to air quality management currently being undertaken by EMM is provided in the following subsections.

7.1 Current EMM Air Quality Management Functions

7.1.1 Ambient Air Quality and Meteorological Monitoring by EMM

Monitoring activities range from on-going maintenance of permanent ambient air quality & meteorological monitoring stations to air quality monitoring campaigns undertaken in

Response to complaints received. The on-going monitoring ranges from old samplers (e.g. SO_2 and soiling index monitors) to new instruments (e.g. Topas - measures PM10, PM2.5, and PM1 and has the potential to be on-line with real-time data transfer). Monitoring responsibilities include laboratory services (for the smoke and sulphur dioxide monitoring) and downloading of data from automatic instruments (e.g. Topas). It is intended that IPC personnel within each SDR operate a

Topas instrument for the purpose of assessing ambient fine particulate concentrations, and own at least one OSIRIS instrument for campaign monitoring in response to complaints received.
Two monitoring stations have recently been installed by GDACE in EMM, viz. at Leon dale (near Wadeville) and at Springs. These stations measure PM10 and various criteria gases (SO_2, NO_2, CO, O_3) in addition to meteorological parameters. EMM has been made responsible for the maintenance of these stations in the long-term. Responsibility within EMM for this role has not yet been allocated.

7.1.2 Diesel Vehicle Testing

All SDRs within EMM are currently undertaken the testing of diesel vehicle emissions, in accordance with the Atmospheric Pollution Prevention Act of 1965, using a Cartridge meter. Initially only council vehicles were tested. Such monitoring is however being rolled out to private vehicles. Efforts are currently being made by the IPC unit to establish links with the metro police department in order to gain their cooperation and assistance in the vehicle emission testing process. It is envisaged that IPC staff will be responsible for conducting diesel vehicle testing in each SDR on at least one day a week. It is envisaged that retesting will be done at test stations.

Although a Standard Operating Practice exists for the testing of emissions from diesel vehicles, there are a number of procedures that are not included, viz.:
-frequency of testing,
-number of vehicles tested, and
-how vehicles are selected for testing.

The IPC unit is currently discussing the possibility of setting quotas with regard to the number of vehicles to be tested. Results from vehicle testing are currently being communicated to the Manger. IPC.

7.1.3 Collation of Source Information

Source and emissions information on certain boilers operations and industrial processes are kept on an *ad hoc* basis by IPC personnel. Lists of boiler operations could only be obtained for the Boksburg area (maintained by the Air Pollution Control Officer) and for the Alrode area (obtained from the Senior Environmental Health Officer, Southern SDR). Source and emissions data for select industries for which complaints were received were also available. No comprehensive, current source and emissions data for industrial sources or non-domestic fuel burning appliances is kept for the EMM.

7.1.4 Air Pollution Control Strategy Development

The IPC unit has identified the need for a strategy and implementation plan for integrated pollution control for the EMM. The Manager: IPC put together a draft strategy intended to promote discussion in this regard within the IPC unit. The IPC unit has committed itself to integrating its knowledge and ideas into the air quality management plan development process underway by the Environment and Tourism Department. Key aspects of the draft IPC strategy are as follows:

- Recognition of the importance of quantifying emissions - including temporal trends in emissions - and of assessing the percentage contribution of sources to total emissions.
- Emphasis on the importance of establishing the height of emissions and the likelihood of human exposure (through dispersion model analysis).
- Various emission reduction measures for household fuel burning, mine tailings, traffic and transportation, industries, non-domestic fuel burning appliances and other sources.

Following the initiation of the air quality management plan development process by the Environment and Tourism Department, the IPC unit agreed to the integration of its ideas and strategies into the air quality management plan being developed.

7.2 Review of Existing Air Quality Management Skills and Tools

7.2.1 Emissions Inventory Data Base

An emissions inventory data base in which source and emissions data for all significant sources of atmospheric emission are stored represent a critical component of effective air quality management. No such data base is currently being developed or maintained within EMM.

7.2.2 Air Quality Monitoring Network and Reporting Practices

Ambient air quality and meteorological monitoring is currently being conducted by various departments and groups within the metro, including: EMM, Airkem, South African Weather Services (meteorological stations) and various industries (e.g. Scaw Metals, Ergo, and Consolidated Modderfontein Mines).

Effective data transfer mechanisms have not been established between the various parties responsible for monitoring. Summary data are, for example, received intermittently by EMM personnel for the Airkem stations when they attend Airkem meetings. The data from the GDACE funded stations at Springs and Leon dale are currently not automatically transferred and are not readily available to either GDACE or EMM. Although EMM will be responsible for the future maintenance of these stations it is not currently clear how the metro will receive access to the data. Data from the EMM run stations, currently operated by IPC personnel, are downloaded manually from the instruments (Topas) or obtained following laboratory analysis (smoke and sulphur dioxide monitoring). Such data are currently only accessed by personnel within the IPC unit.

A significant need exists for the coordination of air quality and meteorological monitoring activities within the EMM. In instances where monitoring is being conducted (or to be conducted) by other parties, effective mechanisms should be put in place to facilitate timely access to data and data sharing.

7.2.3 Atmospheric Dispersion Modelling

No skills or tools currently exist within EMM to support atmospheric dispersion modelling. Such modelling is important for the purpose of effective baseline air pollution characterisation and for assessing the air quality benefits of implementing proposed management and mitigation strategies.

7.2.4 Environmental Risk Assessment and Air Quality Management Skills

Although certain environmental and health risk assessment skills do exist within the Environment and Tourism Department. The persons holding these skills are not currently focused on assessing air pollution impacts. Capacity exists for the development of air quality management planning skills given the expertise and experience of various personnel within the IPC unit and the Environmental Quality and Enforcement section of the Environment and Tourism Department.