Developing an Air Quality Management Plan: Lessons from Limpopo

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A consulting team was appointed by the Limpopo Department of Economic Development, Environment and Tourism (LEDET) to assist in the development of a Provincial Air Quality Management Plan (AQMP). This document reports on the approach, initial findings and challenges faced during the status quo assessment of air quality in the Limpopo province. Challenges included insufficient information from identified sources, limited experience and capacity of air quality personnel, and time lags in information acquisition. The lessons can be applied to AQMP development at provincial, district and priority areas.

Keywords: air quality management plan, Limpopo province, questionnaires, lessons

1. Introduction

Air quality management plans (AQMP) are developed in order to improve air quality; reduce negative impacts on human health and the environment; address the effects of fossil fuels in residential applications; address the effects of emissions from industrial sources and from any point or non-point sources of air pollution. In addition, AQMPs are required to implement the republic's obligations in respect of international agreements; and, give effect to best practice in air quality management.

A consulting team was appointed to assist the Limpopo Department of Economic Development, Environment and Tourism (LEDET) to develop a provincial-scale AQMP. Three (of the five) Limpopo District Municipalities had AQMPs in place - the Waterberg (WDM, 2009), Capricorn (CDM, 2006) and Sekhukhune (GSDM, 2008) District Municipalities. The recently declared the Waterberg-Bojanala airshed priority area (Government Gazette, Number 35435; 15th June 2012) included part of the Limpopo province. The priority area was declared, by the national Department of Environmental Affairs, as a result of concern for the current and future air quality in these districts. A comprehensive emissions inventory and well-formed AQMP at the provincial scale would be able to add value to the AQMP development process for both the Vhembe and Mopani districts and the newly declared priority area.

This report documents the approach to developing a provincial scale AQMP, some preliminary findings and identifies some of the challenges faced during the emissions inventory process especially with respect to major industrial and mining sources of atmospheric pollution.

2. Approach

The approach to compiling a list of sources and quantifying emissions from major industrial and mining sources is reported for three approaches of information-gathering where the approaches were altered as a result of poor response rates.

2.1 Approach 1: Source Identification

The assessment of the *status quo* air quality across the Limpopo province was initiated with the identification of all sources of air emissions within the Limpopo province. This was primarily based on the information captured in the existing District Municipality AQMPs (Waterberg, the Capricorn and the Sekhukhune District Municipalities). For the Vhembe and Mopani DMs, where AQMPs have not yet been developed, the Integrated Development Plans (IDP) for these DMs (MDM-IDP, 2010; VDM-IDP, 2011) were consulted. The APPA Registration Certificate online database was also consulted to identify the sources holding APPA certificates.

2.2 Approach 2: Questionnaires

The consulting team requested the assistance of the individual district municipalities to acquire as much of the information as possible. To assist district municipalities to generate the necessary information, customised questionnaires aimed at gathering the following information were created. The questionnaire included information about any emissions and/or air quality monitoring carried out by the industry concerned. The consulting team collated the data into an industrial emissions data

base. The questionnaires were sent via email to the database including 182 stakeholders.

2.3 Approach 3: Personal communication

A more personal approach was used in the third phase of follow up with identified major sources. The comprehensive source inventory built during approaches 1 and 2 was prioritised into sources expected to account for 80% of the emissions and these stakeholders were contacted telephonically and questionnaires sent via email as follow up. Sources were prioritised based on the number of sources of each type, the expected quantity of emissions from that source type, potential carcinogenic effects of pollutants emitted and the size of operations. Although the remaining sources were plentiful in number, it was expected that they would contribute approximately only 20% of the provincial emissions.

The district Air Quality Officers (AQOs) assisted further by allowing access to AEL applications and emission inventory questionnaires. Further follow-up with major sources was undertaken after the contacts database was updated. Permission to include study findings was requested from major sources, where the consultant team had been involved in EIAs or EMPRs

2.4 Calculation of emissions

During the questionnaire approach an emissions calculator database was developed with the aim that LEDET can maintain and update the emissions inventory once the AQMP is finalised. This spread-sheet based calculator used standard emission rate calculations to quantify emissions from the various industrial and mining processes, based on annual production rates and/or fuel usage.

Other emission sources included the calculation of exhaust emissions from road transport, emissions from domestic fuel burning and emissions from biomass burning. Road traffic volumes were used to calculate exhaust emissions from road transport along with standard emission factors. Domestic fuel burning emissions were based on demographic statistical data from the 2001 Census and the 2007 Community Surveys with recognised emission factors (methodology in WDM-EI, 2012 was followed). Biomass burning emissions were quantified using 2011 burn-scar satellite imagery according to the method of Boschetti *et al.* (2009) together with biomass estimates and emission factors (Van Wilgen *et al.* 2003; Reid *et al.* 2005; Akagi *et al.* 2011 and Wooster *et al.* 2011).

3. Initial Findings

3.1 Information gathering

Consulting the district AQMPs and APPA licence database identified 147 emission sources across the Waterberg, Capricorn and Sekhukhune districts (Table 1). At this stage sources in the Vhembe and Mopani districts were identified only through the APPA Registration certificate database.

Table 1: Major sources identified during Approach 1

District	Major sources	APPA certificates
Capricorn	68	7
Mopani		23
Sekhukhune	52	1
Vhembe		21
Waterberg	27	8

The second approach of enquiry was more successful although the questionnaire response was low (Table 2). The lack of information regarding the location of sources was identified as a potential gap in the baseline assessment.

After discussion with the project steering committee and stakeholders a more personal method was initiated in the third approach of information gathering. This response was more successful especially where the consultant team had existing relationships to acquire information.

Table 2: Major sources identified during Approach 2

District	No. sources	Location data (%)	Questionnaires returned
Capricorn	102	25	2
Mopani	92	28	2
Sekhukhune	86	27	1
Vhembe	33	9	0
Waterberg	80	38	2

At the end of August 2012 a total of 35 major sources had been captured in the emissions calculator (Table 3). Information gathering follow-up continued until the end of September 2012, where after the inclusion of more sources in the emissions

calculator will be recommended as a prioritised strategy in the provincial AQMP in order to achieve effective air quality management in the province.

Table 3: Atmospheric emission sources across Limpopo, captured in the emissions calculator as of August 2012.

District	Industrial	Mines	Brickworks	Wood processing
Capricorn	10	1	1	0
Mopani	1	2	0	4
Sekhukhune	1	7	0	0
Vhembe	0	0	2	0
Waterberg	5	1	0	0
Province	17	11	3	4

3.2 Quantification of emissions

Power generation was found to be the largest source of SO_2 and NO_x emissions across the Limpopo province annually, while biomass burning was the largest source of particulate matter and CO (Table 4). Mining was found to be the second largest particulate matter source. The predominate use of wood (as opposed to coal or gas) results in domestic fuel burning as the second largest source of CO. The low rate of response to the information gathering approaches is likely to result in underestimation of the industrial and mining source emissions. These short-comings will be included as intervention strategies of the Limpopo AQMP.

4. Lessons

The expected value of an emissions inventory to feed into AQMPs at provincial, district and priority area level is dependent on quality of the information collated. The process of developing a provincial level AQMP has highlighted the following lessons.

The data sources identified as initial inputs of information - including the district AQMPs, EIA and AEL databases - were shown to be unavailable or contain insufficient information to quantify emissions. The district AQMPs contributed mostly to the source inventory and less than expected to the emissions inventory. The inclusion of a comprehensive source inventory in favour of a emissions inventory was noticed in several other provincial AQMPs including those for the North-West (NWP, 2009) and Free State (FSP, 2009) provinces. The Western Cape AQMP emissions inventory was limited to fuel burning equipment and scheduled processes with no estimation of the toal pollutant load (WCP, 2010). The inclusion of quantified emissions for the Gauteng province was based on the availability of emission inventories from the three metropolitan municipalities (GDARD, 2009). The transition period between converting APPA licenses to AELs is likely to be a factor in the limited information from these sources.

The AQMP development process includes the evaluation of air quality capacity at multiple levels of government. The process thus far has indicated that at both provincial and district level there is an under capacity for the air quality staff to fulfil their functions in the Limpopo province. It is evident that the AQOs are still building an understanding of the sources in their areas. Similar challenges have been noted by Naiker and colleagues (2012) between the local and provincial government with regards to uncertainty of the roles and responsibilities in respect of air quality management.

Even though the Air Quality Act is implemented, the Limpopo AQMP development process has uncovered that the authority of the provincial and district AQOs is not clearly understood at some levels of government and by some industrial operations. Thus, although sources are legally obliged to provide information to the authorities there is some reluctance to provide the information within the prescribed time-frames, thus hindering information gathering.

The final lesson of interest at this stage is that although commitment has been received from major emission sources the internal time-lags to compile the information will have an impact on the overall project time budget. The project time budget will also be impacted by a more personalised contact approach (as in Approach 3) especially where stakeholder databases are not up to date.

The way forward for the Limpopo AQMP includes the gap analysis and development of intervention strategies. The sources that have not yet been captured in the emissions inventory will be ranked according to their expected emissions and the top 3 to 5 source groups prioritised. The intent is to focus the effort into a few critical sources rather than spending the time and effort in accumulating information from many minor emission source contributions.

Table 4: Estimated annual emissions of criteria pollutants from sources in the Limpopo province

Source group	Criteria pollutants (tpa)					
	SO_2	NO_x	TSP	PM_{10}	$PM_{2.5}$	CO
Brick production	290	123	2 486			193
Incinerators	0.1	1	0.1			0.2
Industrial other*	1 372	28	468			20
Mining			21 663	3 856		
Power generation	668 032	158 292	10 309			
Small boilers	3 571	9 062	8 685			10 630
Smelters	4 976	504	92			771
Wood processing	2 978	187	281			
Road traffic		2 949	97			2 575
Domestic fuel burning	1 953	2 614		2 194		22 967
Biomass burning	3 945	25 644		131 510	65 755	835 090

* Source group includes asphalt plants, fertilizer production and char plant

5. Acknowledgements

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