

Commentary

Air quality evolution in South Africa over the past 20 years: A journey from a consultant's viewpoint

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Introduction

Over the past 20 years, South Africa has made significant progress in implementing frameworks and strategies for the purpose of enhancing air quality through evolving regulations; however, challenges persist. As consultants, we have been at the forefront of navigating and implementing these new regulations, often with some practical difficulties which were not necessarily foreseen. We have been working closely with regulatory bodies to ensure compliance and help industries understand and meet the new regulations. The introduction of stricter regulations demanded innovative solutions, and our role has been crucial in assisting both government and private sectors in fulfilling their obligations. This period has been both challenging and rewarding for air quality consulting.

This narrative, chronicles a journey marked by scientific dedication, regulatory hurdles, and a relentless pursuit of cleaner air for South Africa's communities. It explores the comprehensive process of air quality impact assessments and the development of air quality management plans, covering approaches and methodologies, tools and techniques, the effectiveness of evaluation tools, data requirements and availability, progress and developments, as well as the legal and regulatory framework guiding these processes.

The start of air quality awareness in South Africa

Air pollution in South Africa has been a concern since the 1960's with no formal control of air emissions from industrial and mining operations. Following the Great Smog of 1952, a series of laws were introduced in England (Clean Air Act of 1956 and 1968) to ban black smoke emissions. In South Africa the Air Pollution Research Group at the CSIR (Council of Scientific and Industrial Research) promoted the legal control of air pollution, and as such the Air Pollution Prevention Act, No. 45 of 1965 came into effect, mainly based on the United Kingdom Clean Air Act. The focus was on four main areas: (i) *Industrial sources*, where scheduled processes were controlled by national government through Registration Certificates, mostly dictated through negotiations and based on best practical means; (ii) *Smoke* controlled by local authorities, not allowing open burning and declaring smoke control areas; (iii) *Dust control* applicable only to declared dust



control areas but where mine dumps ended up being controlled by Government Mining Engineer, and (iv) *Vehicle emissions*, also controlled by local authorities through smoke opacity readings but never well executed. The Act provided ambient air quality guidelines, but since these were not regulations, it was not legally enforceable.

Changes under the new constitution

The Constitution of the Republic of South Africa (No. 108 of 1996) states “*Everyone has the right to an environment that is not harmful to their health and well-being, and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures...*”

The early 1990's marked a new era in environmental management and awareness, and the first formal Environmental Management courses commenced in 1992 at the University of Cape Town and in 1993 at the Rand Afrikaans University (now the University of Johannesburg). During this period, air quality was not a primary

focus in environmental management. Most air quality specialists worked in industry, academia, and at the CSIR, and there was no clear guidance as to what air quality assessments should entail.

The National Environmental Management Act of 1998 paved the way for the new Air Quality Act (Act 39 of 2004), which changed the way in which air quality was to be managed in South Africa. The Air Quality Act: (i) shifted the approach to the receiving environment through air quality objectives, (ii) decentralised air quality management with responsibilities at provincial and local government levels, (iii) included baseline air quality characterisation by identifying priority areas, key pollutants, and main contributing sources, (iv) addressed all sources, (v) incorporated a range of emission reduction measures such as command and control, market incentives and disincentives, voluntary reductions, etc., (vi) standardised monitoring (QA/QC, information management, and reporting), and (vii) included public participation and access to information as a requirement.

Not all sections of the Air Quality Act were developed and implemented by the time it was promulgated, and several projects followed resulting in some 40 gazetted publications over the following 20 years. Air quality consultants played an integral part in the development of certain components of the Air Quality Act, such as the Listed Activities and Minimum Emission Standards, the National Ambient Air Quality Standards (NAAQS), Atmospheric Emissions Licence (AEL) application form and format, the National Dust Control Regulations (NDCR) and Air Quality Modelling Guideline, to name a few.

Air Quality Impact Assessments became an integral part of Environmental Impact Assessments, with a growing demand for qualified air quality consultants to conduct these specialist studies and assist industry with their new legal responsibilities such as AEL applications and National Atmospheric Emissions Inventory System (NAEIS) reporting.

National Priority Areas

As part of the drive to cleaner air, three priority areas were declared with the Vaal Triangle Airshed Priority Area (VTAPA) the first in 2005, followed by the Highveld Priority Area (HPA) in 2007 and the Waterberg Bojanala Priority Area in 2012. For each of these, an Air Quality Management Plan (AQMP) had to be developed with the first, *Regulations for Implementing and Enforcing the VTAPA AQMP*, published on 29 May 2009. With the VTAPA AQMP being the first to be developed, this is used as an example of the progress in air quality management.

The drive for clean air in the Vaal Triangle started in the early 1990's due to concerns expressed by the public about levels of air pollution and the respiratory health status of children in the Vaal Triangle. An Air Quality Management Strategy for the Vaal Triangle, aimed at developing intervention strategies to improve poor air quality over the Vaal Triangle region, was conducted in 1997, and the Vaal Triangle Air Pollution Health Study or VAPS, developed by the South African Medical Research Council

in 1998, was a comprehensive epidemiological study which investigated the upper and lower respiratory health status in school children. Another study conducted in the early 2000's quantified the source contributions and identified cost-effective solutions for certain pollutants, areas and sources of concern in the Vaal, including a dose-response for PM₁₀. These initiatives to determine and address the poor air quality in the Vaal Triangle gave rise to the slogan: "Blue skies over the Vaal by the year 2000".

The VTAPA AQMP process and results

The VTAPA AQMP was developed between 2007 and 2009, with the main objective to establish an AQMP that, once implemented, would ensure that the air quality of the area would effectively and efficiently be brought into sustainable compliance with ambient air quality standards within agreed timeframes.

The outcome of the VTAPA AQMP was limited by available ambient monitoring and source data at the time. The Department of Environmental Affairs (now called Department of Fisheries, Forestry and the Environment) commissioned six ambient air quality stations in 2007, with available data indicating elevated PM₁₀, SO₂ and ozone levels. An emissions inventory was developed based on available industry and other source data and used in a dispersion model to determine the main areas of concern. Six "hot spot" areas were identified within the Vaal Triangle indicating the contribution from various source groups to the main pollutants, over the short- and long-term. The Logical Framework Approach (LFA) was then used to determine intervention strategies based on cause-and-effect relationships, resulting in eleven identified problem complexes.

A medium-term review conducted in 2013 found that 46% of the set interventions were successfully implemented, with 18% in progress, 22% could not be achieved, and 14% could not be ascertained. It was found that the industrial stakeholders mostly met their obligations compared to other sectors, with performance of government and municipalities generally low. The Multi Stakeholder Reference Group (MSRG) members overall view was that inadequacy in capacity and the failure to achieve many of the planned interventions and objectives were the main reasons for failing at implementing the 2009 VTAPA AQMP.

In 2017, eight years after the implementation of the 2009 AQMP, the development of the second generation AQMP was initiated with the objective to characterise the air quality and determine the improvement in air quality, if any. This second generation AQMP aimed to establish new strategies and intervention plans, based on a better understanding of the cause-and-effect relationships, that would ensure further improvement and eventual compliance within the area.

Over the 10 years between the publication of the first and finalisation of the second VTAPA AQMPs, there was very little to no improvement in ambient air quality. Large and smaller industry emissions reduced per 2009 intervention commitments

(35% reduction in NO₂, and 25% reduction in PM₁₀) although this was not evident in the ambient air quality. Compared to 2009, domestic fuel burning emissions and vehicle emissions reduced and these are reflected in the PM_{2.5} ambient air quality data. Mining, biomass burning, waste burning and transportation emissions, however, showed little if any improvements. A contributing factor not accounted for in the evaluation is the population in the region, which increased by 22% according to the 2016 Community Survey statistics.

This commentary is based on a keynote address given by Dr Hanlie Liebenberg-Enslin at the National Association of Clean Air (NACA) Conference in September 2024, in keeping with the conference theme of "Air quality evolution: Reflecting on 20 years of progress and charting future paths."

Shortfalls of AQMP implementation

Several factors contributed to the limited improvement in air quality in the VTAPA, with the lack of implementation of the AQMP being the primary one. No political buy-in from decision-making powers resulted in budgetary constraints and a lack of planning. Also, there were too many interventions with some not clearly defined, and limited human resource capacity. Additionally, a shortage of technical skills didn't help. Many of the ambient monitoring stations went out of operation due to the high cost required for maintenance.

Possible reasons for the lack of implementation of the AQMP may be that there are no consequences for failing to implement the set interventions, with no synergy between government departments, and between government and industry, and the public. Over time, stakeholders lost interest in the plan and the methods to create public awareness were inadequate.

Other hurdles included the ironing out of legal requirements, and some factors outside the realm of air quality management. For example, some of the Listed Activities sub-categories were not well-defined resulting in misinterpretation by industry, consultants, and government officials. The aging infrastructure of the government monitoring stations resulted in poor data availability and quality, with load shedding affecting most of the stations. Frequent changes in local municipalities management, with some placed under administration, further hampered air quality management.

The way forward

Since 2009, there have been several publications to assist with AQMP development and implementation, more comprehensive emissions inventories have been developed, and there is a better understanding of the contributing air pollution sources as well as improved technical skills and capacity in the various spheres of government. Furthermore, stakeholder engagements have improved through formal available forums and reporting, and there is overall better public awareness about air quality.

Valuable lessons have been learnt over the past 20 years since the Air Quality Act came into effect, and these have prepared us to make the necessary changes in the next 20 years. So, let's aim for "Blue skies over SA by the year 2040."