

# AN AIR QUALITY MANAGEMENT STRATEGY FOR THE VAAL TRIANGLE

H J ANNEGARN and Y SCORGIE

Schonland Research Centre, University of the Witwatersrand,  
P Bag X3 WITS 2050

## FINAL REPORT ON THE VAAL TRIANGLE INTERVENTION PROJECT

Department of Environmental Affairs and Tourism

### PROJECT LEADERS

A P S TERBLANCHE, Environmentek, CSIR  
H J ANNEGARN, SRCNS, University of the Witwatersrand

## PART 1:

### INTERNATIONAL TRENDS IN AIR QUALITY MANAGEMENT

#### INTRODUCTION

In seeking to find an appropriate strategy for correcting adverse air quality in the Vaal Triangle, we have selected to examine legislation and practices in three international contexts. The European Union Environmental Council has recently (June 1995) published a directive on Ambient Air quality Assessment and Management [EU95]. This document seemed an appropriate and authoritative summary reflecting the current thinking in Europe on air quality management. The document is short (19 pages), focusing sharply on what should be done and the framework for these actions.

The second example is from Great Britain. During 1994 and 1995, new air quality policy and legislation were developed over a relatively short period of time. In March 1994 the first discussion paper was issued (Improving Air Quality – a discussion paper on Air Quality Standards and Management [IM94]). In January 1995 a white paper was published giving the British government's strategic policies on air quality management [A195b], which incorporated comments on the earlier document [IM94]. Legislation was enacted in August 1995 (Environment Act of 1995, Part IV Air Quality). The two policy documents provide an in depth motivation for a fresh approach to improving air quality and appeared to offer useful approaches for our South African situation. While being comprehensive, the approach is less legalistic than United States policies. The new British approach is very similar to the European Council policy mentioned above. However, for regions of urgency the British government proceeded to write the policy into law, without waiting for the possibly drawn out procedures of the European Union to reach finality. As South Africa's current Air Pollution Prevention Act is formed largely on earlier British experience and legislation, it seemed relevant to examine the present trends in Britain.

The United States has been chosen as a third model, for the reason that their policies have been tested in practice over more than two decades. The new European approaches have

yet to be road tested, while the pot-holes developed from use over many years in the US Environmental Protection Agency (EPA) regulations may guide us on a safer path, demonstrating both what works and is useful, and as important, what to avoid. EPA Guidance documents on State Implementation Plans (SIPs) for improving air quality, and actual examples of SIP documents are used as source material.

The following sub-sections discuss aspects of the three approaches which are of possible assistance in formulation of an intervention strategy for improving air quality in the Vaal Triangle.

### EUROPEAN COMMUNITY AMBIENT AIR QUALITY DIRECTIVE

The brief language of the European Union Directive on Ambient Air Quality Assessment and Management provides a useful model relevant to South Africa and the Vaal Triangle. As the meaning and implications are complete, we will quote extracts with minimal comment.

#### Article 1: Objectives (cited in full)

The general aim of the Directive is to define the basic principles of a common strategy to:

define and establish objectives for ambient air quality in the European Community designed to avoid, prevent or reduce harmful effects on human health and the environment as a whole;

assess the ambient air quality of Member States on the basis of common methods and criteria;

obtain adequate information on ambient air quality and ensure that it is made available to the public, inter alia by means of alert thresholds;

maintain ambient air quality where it is good and improve it in other cases.

The explicit reference to public accessibility in this short statement reflects the principle of public access to environmental information contained in South Africa's new constitution.

The plain English statement gets to the essence of the matter avoiding complex debates on the meaning of terms (sustainability, BATNEEC, subsidiarity) which has characterised much of the recent policy debate in South Africa.

#### Article 2 (selected extracts) Definitions

5. "Limit value" (of a pollutant concentration) means a value fixed on the basis of scientific knowledge, with the aim of avoiding, preventing or reducing harmful effects on human health and/or the environment as a whole, to be attained within a given period and not to be exceeded once attained;

6. "Target value" means a level fixed with the aim of avoiding more harmful long-term effects on human health and/or the environment as a whole, to be attained where possible over a given period;

7. "Alert threshold" means a level beyond which there is a risk to human health from brief exposure and at which immediate steps shall be taken by the Member States as laid down in this Directive;

8. "Margin of tolerance" means the percentage of the limit value by which this value may be exceeded subject to conditions laid down in the following Articles;

10. "Agglomeration" means a zone with a population concentration in excess of 250,000 inhabitants or, where the population is 250,000 inhabitants or less, a population density per km<sup>2</sup> in which the Member States justifies the need for air quality to be assessed and managed.

These definitions of Alert, Limit and Target values provide a fresh definition of what are commonly known as "standards". These definitions are of crucial importance to the new approach, and provide a sharp contrast to the previous concepts of standards as being levels above which criminal-type liability is incurred. The new values recognise that changes in ambient air quality are extensive in time – if levels are not satisfactory then remedial action cannot be instantaneous. The definitions link concentrations to harmful effects, to appropriate corrective action over suitable time scales (alert = immediate; limit = within a given time; target = over a given time). The definitions point to an assessment and management process, rather than an enforcement process. This is borne out in the subsequent sections of the Directive.

#### Article 3 Implementation and responsibilities

For implementation of the provisions of this Directive, Member States shall designate at the appropriate levels the competent authorities and bodies responsible for:

- implementation of the Directive
- assessment of air quality;
- approval of measuring devices (methods, equipment, networks, laboratories);

ensuring accuracy of measurement ... quality assurance standards;

analysis of assessment methods;

coordination on their territory of Community-wide quality assurance programmes organized by the Commission.

Implicit in this Article is that various functions need to be delegated to various levels of government (national, provincial and local, and special institutions – standards laboratories). It is inappropriate to say that one or other level of government will have sole or prime responsibility. For the Vaal Triangle, the first two items appear to be appropriate for local government attention.

#### Article 4 Setting of the limit values and alert thresholds for ambient air

1. For those pollutants listed, the Commission shall submit to the Council proposals for setting of limit values and, as appropriate, alert thresholds according to the following timetable:

no later than December 1996 for pollutants 1 to 5;

... (special directive for ozone)

as soon as possible and no later than 31 December 1999 for pollutants 7 to 13.

The listed pollutants are:

Governed by existing air quality directives

1. Sulphur dioxide
2. Nitrogen dioxide
3. Fine particulate matter such as soot
4. Suspended particulate matter
5. lead
6. Ozone

Other ambient air pollutants (now to become regulated)

7. Benzene
8. Poly-aromatic hydrocarbons
9. Carbon monoxide
10. Cadmium
11. Arsenic
12. Nickel
13. Mercury.

This paragraph is quoted to illustrate the expanded range of pollutants now considered important to control in the ambient environment, and also that limit and alert values are set explicitly (again incorporating the time/planning element into the process).

3. When limit values and alert thresholds are set, criteria and techniques shall be established for:

- (a) the measurement to be used ....
  - the location of the sampling points;
  - the minimum number of sampling points;
  - the reference measurement and sampling techniques;

- (b) the use of other techniques for assessing ambient air quality,
  - in particular modelling;
  - spatial resolution for modelling and objective assessment methods;
  - reference modelling techniques.

These criteria and techniques shall be established in respect of each pollutant according to size of the agglomerations or to the levels of pollutants in the zones assessed.

The concepts of *Alert*, *Limit* and *Target values* are now expanded from purely a concentration levels of a substance in the atmosphere, to include the methods and location of sampling that substance. This paragraph thereby limits the potential inappropriate or incompatible uses of data obtained by diverse methods.

The parity of monitoring and modelling is established for compliance planning.

In the last paragraph explicit account is taken of the size of the zone and the seriousness of the pollution in setting the scale of effort needed to address problems. The emphasis is that the proposed system is responsive to needs, rather than being driven by a legalistic formula.

- 4. To take into account the actual levels of a given pollutant when setting limit values and the time needed to implement measures for improving air quality, the Council may also set temporary margins of tolerance for the limit value.

The margin shall be reduced according to procedures to be defined for each pollutant in order to attain the level of the limit value at the latest at the end of a period to be determined for each pollutant when that value is set.

#### **Article 5 Preliminary assessment of ambient air quality**

Member States which do not have representative measurements of the levels of pollutants for all zones and agglomerations shall undertake series of representative measurements, surveys or assessments in order to have the data available in time of implementation ...

#### **Article 6 Assessment of ambient air quality**

- 1. Once limit values and alert have been set, ambient air quality shall be assessed throughout the territory of the Member States ...
- 2. ... measurement is mandatory in the following zones:
  - agglomerations (i.e. no. of inhabitants > 250,000)
  - other zones where levels exceed the limit value. ...
- 3. A combination of measurement and modelling techniques may be used to assess ambient air quality where the levels over a representative period are lower than the limit value ...

- 4. Where pollutants have to be measured, the measurements shall be taken at fixed sites either continuously or by random sampling in sufficiently large numbers.

#### **Article 7**

##### **Improvement of ambient air quality**

##### **General requirements**

- 1. The Member States shall take the necessary measures to ensure compliance with the limit values.
- 2. Measures taken in order to achieve the aims of this Directive shall:
  - (i) Take into account an integrated approach to the protection of air, water and soil; .....
- 3. Member States shall draw up action plans indicating the measures to be taken in the short term where there is a risk of the limit values and/or alert thresholds being exceeded, in order to reduce the risk and to limit the duration of such occurrence. Such plans may, depending on the individual case, provide measures for the control and, where necessary, suspend activities, including motor vehicle traffic, which contribute to the limit value being exceeded.

Without fuss or protracted debate, the concept of integrated pollution control is introduced as an underpinning of pollution control planning.

#### **Article 8**

##### **Measures applicable in zones where levels are higher than the limit value.**

- 1. Member States shall draw up a list of all zones and agglomerations in which the levels of one or more pollutants are higher than the limit value plus the margin of tolerance. (If margin of tolerance not set, treat as zero.) ...
- 2. Member States shall draw up a list of all zones and agglomerations in which the levels of one or more pollutants are between the limit value plus the margin of tolerance.
- 3. In the zones and agglomerations referred to in paragraph 1, Member States shall take measures to ensure that a plan or programme is prepared or implemented for attaining the limit value within the specified time limit.

This plan or programme, which must be made available to the public, shall incorporate at least the information listed in Annex IV. (*Not reproduced*)

Here the principle of transparency and public participation, central to political life in the new South Africa, is introduced.

- 4. Where more than one pollutant exceeds the limit values ... provide an integrated plan covering all pollutants concerned.

5. The Commission shall regularly check the implementation of the plans submitted under paragraph 3 by examining their progress and the trends in air pollution.

Here the concepts of planning are introduced as the central feature of environmental management, as opposed to an enforcement approach. This of course does not rule out enforcement of specific planning provisions as an implementation tool, but the language of enforcement is purposely excluded from the policy approach. Planning, and checking progress against the plan are given ascendancy.

#### Article 9

##### Requirements in zones where the levels are lower than the limit value.

Member states shall draw up a list of all zones and agglomerations in which the levels of pollutants are below the limit values.

The Member States shall maintain the levels of pollutants in these zones and agglomerations below the limit values and shall endeavour to preserve the best overall ambient air quality, compatible with sustainable development.

The placing of the concept of sustainable development is interesting, in the light of the great emphasis placed on this concept in the current policy debates in South Africa. Here sustainable development only becomes a pertinent criterion when human health and environment have received adequate protection.

#### Article 10

##### Measures applicable in the event of the alert thresholds being exceeded

When the alert thresholds are exceeded, Member States shall undertake to ensure that the necessary steps are taken to inform the public (e.g. by means of the press, Radio and television). ...

This completes for the moment consideration of the European Community proposals. We shall return to this detailed listing as a model of a possible intervention strategy for the Vaal Triangle.

## UNITED KINGDOM

### IMPROVING AIR QUALITY – THE EFFECTS BASED APPROACH

The introduction of the United Kingdom discussion document "Improving Air Quality" [IM94] contains a useful discussion on the reasons for a shift from a source based control policy to an effects based approach. As South African air pollution control was modelled on the earlier British approach, consideration of why Britain itself has evolved a new approach may inform the South African debate. We quote the three paragraphs from this section:

1.5 ... The Government believes that further progress (towards a more comprehensive framework for air quality management) must be based on the further development of an effects-based approach, complemented by source based controls. The essence of this approach is that the regulation and control regimes and strategies which aim to prevent specific emissions, by the introduction of cleaner technology or reduce them by pollution abatement or other technological means, while important, are unlikely to be sufficient on their own: it is important also to assess the impact of air pollution on human health and the environment, to set standards for specific pollutants in the light of this, and then to establish a comprehensive programme designed to secure those standards in the best way possible.

1.6 There are two fundamental reasons why the Government continues to consider that the further development of an effects based approach is the most appropriate way forward for air pollution policy.

It ensures that policy is focused on objectives rather than means – this enables development of innovative approaches such as market based instruments; and

It provides a basis for ensuring the policies are cost effective and not disproportionate, and that the environment gains from regulatory control can be properly quantified and judged.

1.7 An effects based approach does not dispense with technology based controls. These remain essential. It simply provides an effective frame of reference by which they can be measured and judged.

These paragraphs introduce two further principles which have emerged as important considerations in the South African debate, namely cost effectiveness and proportionality.

Implications of a shift to an effects based approach in South Africa are that our present system of *best practical means* (BPM) would be substantially modified. The principal of BPM, as implemented in South Africa, namely the issuing of operating permits specifying maximum emission rates, would still be used. However, it would be only one control technique among a range of intervention strategies and techniques.

### STANDARDS

The discussion document has a lengthy discussion on the topic of air quality standards, including current standards and their limitations, a framework for standards and considerations in setting standards. The discussion provides useful background material justifying the concepts "alert threshold", "limit value" and "target value" as defined in the European Community Directive. The British document evolves three standards using

slightly different names, but essentially identical to the EU Directive definitions.

### AIR QUALITY – MEETING THE CHALLENGE

A document with the above title contains the British Government's white paper on strategic policies for air quality management [A195b]. The three main areas addressed are a new framework of national air quality standards and targets, based on effects based approach as discussed above; a new system for local air quality management, based on **Air Quality Management Areas**; and effective control of emissions, particularly from vehicles.

For Britain, the present and emerging air quality issues are closely related to vehicle emissions, and are comprehensively addressed. For the Vaal Triangle, vehicle emissions are certainly a medium to long term issue, but not as important as the immediate issue in Britain. This issue is thus not presented in detail here.

The new framework for local air quality management will be based on **Air Quality Management Areas**. This will:

- require periodic review of air quality by all local authorities;
- provide for establishment of Air Quality Management Areas in those places where air quality targets are unlikely to be met;
- place powers and obligations on local authorities and other relevant bodies to prepare plans for remedying air quality problems in Air Quality Management Areas;
- secure for the first time the effective cooperation of all activities which can influence air quality improvement in the most cost effective manner in those areas where it is most needed.

In addition to covering all the details and principles covered in the EU Directive, the British policy brings out two further major considerations, namely the links between local air quality and land use planning; and the link between air quality and transportation planning. Local transport strategies aimed at reducing the need to travel and encouraging use of less polluting modes of transport are simultaneously key air quality improvement strategies. While land-use planning can make relatively little contribution to immediate improvements in air quality, over longer term the development planning system is central to policies which will evolve sustainable cities.

As with the EU Directive also, there are emphases placed on the role of pollution monitoring and public information. There are careful distinctions drawn on the appropriate functions of central government, for instance in setting standards (as newly defined) and procedures for monitoring, and providing technical assistance on modelling and source inventory development. Likewise, appropriate roles are delineated for local authorities in planning and implementing control measures within the defined air quality management areas. The paper

has much useful material to guide South Africa in finding the appropriate division of competencies between national, provincial and metropolitan structures.

## UNITED STATES

### EPA AND STATE IMPLEMENTATION PLANS

Air pollution control in the United States has developed into a major government activity, through the Environmental Protection Agency. A sizable industry has grown to provide the hardware for gas scrubbing, industrial and ambient monitoring, and consulting. From a South African view point, the US environmental control system often seems over regulated, with disproportionate resources spent on legal disputes. This view has much justification in the late sixties and seventies. In the late eighties the EPA has moved towards partnerships approach with industry, providing technical advice and development, while nevertheless maintaining its role as the legal enforcement agency.

Urban metropolitan air quality planning is enforced at a state level. Areas not meeting National Ambient Air Quality Standards (NAAQS) for specified pollutants are designated as not in compliance. State or regional governments are required to submit plans (known as State Implementation Plans or SIPs), showing how air quality will be managed so that standards will be met, showing reasonable progress towards a goal over a time span not to exceed 5 years. Failure to submit a plan, or negligently failing to meet the goals may be punished by withdrawal of Federal highway funding to the State (if the pollution is traffic related) or withdrawal of industrial development funding and mandatory freeze on new source permitting (if pollution is industrial sourced). The punitive measures, while severe, are intended to encourage compliance by targeting appropriate sectors.

The EPA provides extensive guidance documents on the development of State Implementation Plans. Requirements for SIPs include most of the features already mentioned in the discussions on the European and British policies above, namely standards, modelling, monitoring, definition of air quality management areas. One major difference in the US approach is a strong emphasis on **quantitative emission inventories** as a basis for all control strategies. The lack of explicit mention of emission inventories we regard as a serious weakness in the EU and British policies. Modeling, both dispersion and receptor, have a much greater emphasis in the US approach. In fact, attainment of future year compliance in most cases is to be demonstrated by modeling for the plan to be accepted by the EPA.

SIPS should contain also the prioritised list of control measures needed to attain compliance, together with detailed, realistic assessments of the costs and pollution reductions of each proposed measure.

Public participation is a key component of SIP development, and highly formalised. Public hearings are held, and verbatim transcripts of public comments (written and oral) become part

of the public record of plan development and approval. The negative experiences of South Africa that extensive consultation can in practice slow down or completely halt new developments, is avoided by having legislated response times for deposition of comments, public review periods, and for processing of each stage by regulatory authorities.

## **COLORADO STATE IMPLEMENTATION FOR CARBON MONOXIDE**

### **DENVER METROPOLITAN NON-ATTAINMENT AREA**

As the legislation, and technical guidance documents provided by the EPA are voluminous, we considered that it may be more useful to take actual State Implementation Plans as a basis for discussion. While the EU Directive and the new British policy have the elegance of relative brevity, they have not yet been tested in practice. By looking at recent examples of SIPS, we gain insights into how specific applications are developed, and come face-to-face with some potentially intrusive measures which may be required, also in South Africa, in order to improve urban air quality. The first plan considered is for carbon monoxide control in Denver, Colorado [CO94]. The plan was accepted in June 1994. Colorado was selected as a city of comparable size to greater Johannesburg, and similar elevation to Vaal Triangle and the rest of Gauteng.

#### **The Denver Area Carbon Monoxide Plan**

“People in the Denver metropolitan region want to breathe clean air. They value good air quality for health and aesthetic reasons, and also as an integral part of a healthy economy.”

Opening statement of the Denver Carbon Monoxide SIP.

The necessity for the Denver SIP followed on the sweeping amendments to the Clean Air Act in 1990, after a prolonged debate in the US over how to strengthen air quality improvement efforts. While the Act included many mandated programs and stricter standards, it also allowed local areas, through the SIP process, to choose additional clean air programmes that addressed local conditions and would have the most benefit at the lowest cost.

This latter point is crucial to the recommendations to be developed for interventions in the Vaal Triangle. While it is possible that under the 1996 Constitution, Provinces have been assigned competencies for environmental matters, it is believed that local areas are best able and have the strongest motivation to develop cost effective strategies which meet the aspirations and needs of residents, businesses and industries.

Preparation of the Denver SIP was drawn up by the Regional Air Quality Council (RAQC). As the Denver CO non-attainment area spans several counties, and includes several independent local authorities (for example Denver metropolitan, Boulder), it was necessary for some over-arching body to be created to coordinate activities on this broader scale. The

RAQC was constituted by the state governor, and is composed of elected officials from local government throughout the region, with local governments, relying heavily on human resources from existing pollution control and health divisions. In the context of the Vaal Triangle, the analogy is that a body to coordinate air quality would have to cross Gauteng - Free State provincial divide, as well as spanning multiple metropolitan authorities.

The contents pages of the Denver Carbon Monoxide SIP provides an indication of steps required in the planning process. The first chapter reviews the process by which the non-attainment designation was reached. Following a brief discussion on the sources, monitoring and health effects of CO, there is a substantial chapter on emission inventories, both for the base year (1990 in this case) and future year inventories. These projections obviously require estimates of anticipated urban growth in population and vehicles for instance, illustrating again the necessity for close involvement with urban and transportation planners.

Modelling is described in the Chapter IV, in this case the Urban Airshed model being the appropriate choice. Validation of the base year case against inventory and monitoring results is followed by future year predictions.

Already implemented control measures and their effectiveness are described next. These include:

- Federal emission standards  
(implemented by catalytic converters on motor vehicles);
- Oxygenated gasoline;
- Enhanced inspection / maintenance of vehicles;
- Alternative fuels;
- Transportation system improvements;
- Wood burning control measures.

Additional control measures are then identified, and motivated in detail one by one, including in each case an evaluation of cost and economic impact. The measures included at this level are:

- Increase in oxygenated gasoline 2.7% to 3.1%;
- Reduce emissions from high emitting vehicles (<1982);
- Transportation management measures (car pooling, cycling promotion, flexi-hours).

As part of the long term maintenance plan, further measures considered included free carpool parking in central Denver, parking supply restrictions on new development in downtown Denver, mandatory employer-based travel reduction programmes and regional parking surcharges, vehicle usage and emission taxes, limit sulphur content in gasoline, mandatory no-drive days for high emitting vehicles. Interestingly, a list of further measures which were not recommended is given. Reasons for rejection include lack of equity or cost effectiveness, or do not effect travel behaviour e.g. vehicle registrations surcharge, mandatory no-drive days for all vehicles.

The key concluding chapter is on attainment demonstration, in which the combination of control measures and future modeling

shows how carbon monoxide concentrations at key indicator sites will be within the NAAQS limits by the designated date. Included are a short list of contingency options which will automatically be implemented if the predicted improvements are not achieved on schedule.

## **SANTA BARBARA COUNTY'S PLAN TO ATTAIN THE FEDERAL AND STATE**

### **OZONE STANDARDS – 1994 CLEAN AIR PLAN**

Santa Barbara, a county in southern California, was in non-attainment of ozone. The 1994 Clean Air Plan [SA94] follows a very similar format to the Denver CO SIP, although the document is considerably more complex. This follows from the nature of ozone as a secondary pollutant, so that both nitrogen oxides (NO<sub>x</sub>) and volatile organic compound (VOCs) precursors have to be inventoried and modelled, and both have fixed and mobile sources.

We highlight only one or two aspects from this Santa Barbara document. Firstly, the Air Pollution Control District Board again comprised representatives from several independent authorities. In this case, to reduce duplication, an existing cooperative council, the Santa Barbara County Association of Governments, comprising twelve representatives, doubled also as the Santa Barbara County Air Pollution Control District Board. Scientific and technical work in preparing the plan was delegated to a project team headed by two professional engineers.

From direct discussions with one of the project team, we learnt that implementation of the Santa Barbara plan, tracking of data and progress tracking requires an office staffed by two or three graduate professional engineers, plus supporting technical and administrative staff. In terms of the current resources assigned to air quality management in South Africa, this appears a quantum leap up in human resources. However, in comparison to staffing of municipal engineering departments for solid waste and waste water management, such staff levels would not be out of place for a metropolitan area incorporating all substructures of the Vaal Triangle.

### **EMISSION REDUCTION STRATEGIES: INTERNATIONAL EXPERIENCE**

US SIPs initially list all available control measures contained in the EPA guidance documents [CO94, CO95, SA94, OW94]. The EPA issues guidance for various source categories, including: urban fugitive dust, residential wood combustion, and prescribed silvicultural and agricultural burning. Reasonably Available Control Measures (RACM) are then determined for the particular area, considering technological and economic feasibility in the area. A plan need not include all measures defined by the EPA, but must show that attainment of standards is assured, and that the application of the measures omitted would not result in attainment any faster.

The experience of United States and various European countries has shown that emission reductions achieved from traditional "command and control" style regulation may be dimin-

ishing. Although regulations on business and industry that require specific air pollution controls have been successful in reducing emissions, such measures may not be successful in curbing emissions from other sources of pollution such as domestic coal burning, and re-entrained dust from paved and unpaved roads. Future emission controls should thus consider using alternatives to prescriptive rules.

To effectively control the remaining sources of pollution and provide continued air quality progress, new solutions should be explored. Many of the new solutions being investigated in the US focus on the use of market-based incentives which can provide an economic impetus for reducing air pollution. The Santa Barbara Clean Air Plan for example proposes a Regulatory Flexibility Program which is intended to encourage businesses and industry to find new ways to control air pollution by providing incentives in the form of reduced compliance costs [SA94].

In the US design concentrations are used to ascertain the general level of control needed to demonstrate attainment of ambient air quality guide-lines or standards [CO95, CO94, SA94]. The design concentration is computed through the use of dispersion modelling, and is assumed to be the sum of concentrations contributed by all sources in the region in addition to appropriate background concentrations. Through a comparison of acceptable ambient levels as defined by guide-lines, and design concentrations determined, it is possible to establish the level of control needed.

Once the level of control has been determined, a proportioning method can be used to establish the emission limit required for each source. In the proportioning method source contributions are determined from receptor and/or dispersion modelling.

### **CONCLUSION**

The essence of the SIP plans is that careful evaluation and documentation of all proposed methods for reducing emissions allows for rational, equitable decision making.

The scale of planning for the USA SIPs is similar to the Air Quality Management Areas of Britain, or the "agglomeration" concept used in the EU Directive. In all cases, an effects based approach is the basis for planning. While the US law is still based on enforceable standards, the Europeans have adopted a more flexible and realistic approach to standards as target levels, or indicators for certain levels of planning action. The confrontational aspect is removed from environmental management.

Technical contents of the air quality plans are essentially similar, based on assessment (monitoring), modelling, evaluation and then implementation of control measures, continued monitoring to track progress, and public participation as an integral thread.

After reviewing the current situation in South African air pollution control, we will offer suggestions for a Vaal Triangle intervention strategy, drawing on aspects of the three models discussed above.

While full access to the technology of the US may be lacking in South Africa, many of the necessary components of such a plan are already available. These will be discussed below.

## AIR POLLUTION CONTROL IN SOUTH AFRICA

### CURRENT AIR POLLUTION CONTROL IN SOUTH AFRICA

The Department of Health, formerly the Department of National Health and Population Development, was responsible for air pollution control prior to April 1995. Currently, air pollution control is administered at a national level by the Department of Environmental Affairs and Tourism (DEAT) according to the Atmospheric Pollution Prevention Act No. 45 of 1965, as amended (the Act).

Atmospheric emissions from all industries undertaking scheduled processes, as defined in the Act, are subject to control by the Chief Air Pollution Control Officer (CAPCO). Although emission limits and ambient concentration guidelines are published by CAPCO, no provision is made in the Act for ambient air quality standards or emission standards.

The approach used by CAPCO is based on the concept of Best Practicable Means (BPM), and is implemented primarily by issuing permits to operate providing emissions are below prescribed levels. In determining permit levels, CAPCO has discretion under the Act to take into account available technology, costs of abatement, age of plant, local and special circumstances. 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.

Local authorities are responsible, on application to the Minister (of the DEAT), for regulation of emissions from domestic fuel combustion. Once the Minister has declared a smoke control zone, control is affected by the local authority by types of permitted fuel-burning appliances and fuels in the areas of jurisdiction. Under the Act, provincial tiers of government are not involved in air pollution control.

Control of vehicle emissions is also administered at local level, and under the Act is limited to control of visible smoke emissions from diesel powered vehicles. Emissions from gasoline powered vehicles are not regulated.

### PROBLEMS WITH CURRENT CONTROL STRUCTURES AND LEGISLATION

Administration of air pollution control in South Africa has, in practice, become highly fragmented. At a national level, various departments are responsible for implementing various sections of the Act, including the Department of Health, the Department of Environmental Affairs and Tourism, and the Department of Mineral and Energy Affairs. Comprehensive control of air pollution at a local level is hindered due to the division of responsibilities for implementing regulations between national and local authorities.

Air pollution control within metropolitan areas is similarly impeded due to the division of authority among several local authorities. Each metropolitan area may have several air pollution control officers and town planners, each operating within their own municipal boundaries. Since air pollution does not adhere to political boundaries, effective air quality management is possible within an air basin only through a coordinated authority.

The fragmented organisational structure of air pollution control has several adverse consequences:

- Discrepancies, anomalies and ineffectiveness in air pollution control;
- Air pollution considerations afford fairly low priority in planning;
- Answers required for air pollution management decisions can not be obtained quickly;
- Air pollution control personnel do not form a coherent and recognisable body and consequently lack both status and authority and have few prospects for promotion;
- The national authority is not bound in all respects by its own legislation. This provides the potential for inconsistencies and subjectivity in the decision making process.

In addition to the fragmented organisational structure of air pollution control authorities, persistent inadequate staffing at national level has severely limited the effective enforcement of the existing legislation.

The nature of the present air pollution legislation similarly has several shortcomings:

- It does not deal with all pollution sources. Various sources of fugitive dust emissions, such as roads, open pit mining, construction and demolition and agriculture have been omitted. Emissions from biomass burning, aviation, and toxic substance transport and spills have also been overlooked.
- Air pollution control is currently based entirely on source-based controls rather than on the achievement and maintenance of ambient air quality standards.
- Not enough attention has been paid to exposure levels, for example human exposure to domestic coal burning emissions in townships.

### RECOMMENDED STRUCTURE FOR FUTURE AIR QUALITY MANAGEMENT

The Integrated Pollution Control (IPC) Project of the Department of Environmental Affairs and Tourism was initiated circa 1993 to facilitate a review of present governmental functions and structures concerned with pollution control, and to initiate a process of restructuring of the regulatory system to produce a more effective pollution control system [IN95b]. The IPC Air Work Team were responsible for drafting a new approach to air pollution control amenable to Integrated Pollution Control. The new approach to air quality management and the



recommended restructuring of authorities responsible for such management put forward by the air work team forms the basis of the current study [A195a].

Four tiers of authority are foreseen in the execution of control of air pollution:

- It is recommended that the mandate for the coordination of air quality management be given to a single national agency. Functions of the national agency would include legislation, transboundary pollution management, international agreements, dispute resolution and the demarcation of Local Air Quality Management Areas.
- Provincial authorities will be charged with main executive powers for the implementation of control, which may be delegated to lower tiers where the capacity exists.

- Metropolitan authorities will be responsible for Local Air Quality Management Areas as identified by the national agency.
- Local authorities outside metropolitan areas may derive certain powers from provincial authorities, commensurate with their abilities.

#### ACKNOWLEDGEMENTS

This report is published with the permission of the Chief Air Pollution Control Officer, Department of Environmental Affairs and Tourism. The authors acknowledge financial assistance obtained from the Department.

**CONSULTO**  
**ENVIRO** CC/BK  
Air Pollution Engineering



P O Box 8530  
0046 Hennopsmeer  
No. 8 Uitzicht Offices  
John Vorster Drive South

Posbus 8530  
0046 Hennopsmeer  
Uitzicht Kantore Nr. 8  
John Vorsterrylaan Suid  
Highveld, Verwoerdburg  
Tel: (012) 665 1688:Tel  
Fax: (012) 665 1688 :Faks

#### RAADGEWENDE DIENSTE

LUGBESOEDELING INGENIEURSWESE

DIAGNOSTIESE TOETSE

VENTILASIE-NYWERHEIDSTOEPASSINGS

#### CONSULTING SERVICES

AIRPOLLUTION ENGINEERING

DUAGNOSTIC TESTS

VENTILATION-INDUSTRIAL APPLICATIONS