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SOUTH AFRICAN NATIONAL STANDARD

Framework for setting and implementing national ambient air quality standards

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Table of changes

Change No.	Date	Scope

Acknowledgment

Standards South Africa wishes to acknowledge the valuable assistance derived from publications of the following organizations:

Environment Council of the European Community

Foreword

This South African standard was approved by National Committee STANSA TC 5140.43, *Air quality*, in accordance with procedures of Standards South Africa, in compliance with annex 3 of the WTO/TBT agreement.

Introduction

The ambient air quality standard setting process has as its basis the following:

- a) The Draft Environmental Management: Air Quality Bill makes provision for the identification of priority pollutants and for the setting of air quality standards.
- b) The Minister of Environmental Affairs and Tourism may, with the concurrence of the member of the executive committee (MEC), and the MEC may, with the concurrence of the Minister, designate more stringent ambient standards for specifically defined geographical areas.
- c) In order to protect the environment as a whole and human health, concentrations of harmful air pollutants should be avoided, prevented or reduced and limit values or alert thresholds (or both) set for ambient air pollution levels.
- d) The numerical values for limit values, alert thresholds and, as regards ozone, target values or limit values (or both) and alert thresholds are to be based on the findings of work carried out by international scientific groups active in the field, and shall take into account the wealth of local knowledge and relevant local conditions.
- e) Ambient air quality needs to be assessed against the limit or target values or the alert thresholds (or all three), taking into account the size of populations and ecosystems exposed to air pollution.
- f) The framework, as given in this standard, has to be supplemented by regulations specific to individual substances covered, utilizing the process defined in this framework.
- g) To fulfil the overall objective of this framework, the supporting regulations, guidance documents, preliminary assessments and standards finalization process stipulated within this standard need to be completed.
- h) Preliminary representative data on the levels of pollutants should be collected, following the process identified in the Guidance Report on preliminary assessment under the framework for the setting and implementation of air quality objectives (see clause 5 and clause 8).

- i) In order to protect the environment as a whole and human health, it is necessary that provincial and local authorities take appropriate action when limit values are exceeded as defined by this framework and in associated documents or standards (or both).
- j) Measures taken by national government and provincial and local authorities shall take into account and be aligned with other relevant national strategies and policies.
- k) Provinces should consult with one another if the level of a pollutant exceeds, or is likely to exceed, the limit value plus the margin of tolerance or, as the case may be, the alert threshold, following significant pollution originating in another province.
- l) In order to facilitate the handling and comparison of data received, such data should be provided to national authorities in standardized form.
- m) The implementation of a wide and comprehensive policy of ambient air quality assessment and management needs to be based on strong technical and scientific grounds and with due regard for sustainability criteria (health benefits compared to socio-economic costs).
- n) The national authorities are to support studies to analyse the effects of the combined actions of various pollutants or sources of pollution and the effects of climatic and local meteorological conditions on the activities of the various pollutants examined in the context of this framework.
- o) Air quality objectives which are more stringent than national limit values may be issued by local and provincial authorities provided that the national authorities are notified of this intention and further that these are based on sound reasoning.

Framework for setting and implementing national ambient air quality standards

1 Scope

This standard defines the basic principles of a strategy to

- a) define and establish objectives for ambient air quality in South Africa designed to avoid, prevent or reduce harmful effects on human health and the environment as a whole, taking into account technical, economic, social, political and strategic considerations;
- b) assess the ambient air quality within provinces and within metropolises and towns on the basis of common methods and criteria;
- c) establish adequate data bases of ambient air quality at local government level that is consolidated on a national basis and that assists with prioritization on local and at national levels;
- d) report air quality information to the public, particularly in instances where air pollution levels can be harmful; and
- e) endeavour to preserve ambient air quality where it is good and improve it in other cases, compatible with sustainable development.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this standard. All standards are subject to revision and, since any reference to a standard is deemed to be a reference to the latest edition of that standard, parties to agreements based on this standard are encouraged to take steps to ensure the use of the most recent editions of the standards indicated below. Information on currently valid national and international standards can be obtained from Standards South Africa.

2.1 Standards

SANS 1929, *Ambient air quality limits for common pollutants*.

2.2 Other publications

van Niekerk WA, 2001, *Technical Background Document for the Development of a National Ambient Air Quality Standard for Sulphur Dioxide*.

NOTE Published in Government Gazette No. 22134 of 1 June 2001, Notice 1404 of 2001.

3 Definitions

For the purposes of this standard, the following definitions apply:

3.1

air quality standard

comprises health-risk or environmental-risk based limit values (or both) and associated averaging periods indicative of exposure durations in addition to the following criteria:

- 1) monitoring and data management protocols for air quality assessment and reporting,
- 2) permissible frequencies of exceeded limit values within defined time frames, and
- 3) time frames for achieving compliance in non-attainment areas

3.2

ambient air

outdoor air in the troposphere, excluding work places, where air quality is determined in accordance with SANS 1929

3.3

agglomeration

area with a population exceeding 250 000 inhabitants or, where the population is 250 000 inhabitants or less, a population density per square kilometre which justifies the need for ambient air quality to be assessed and managed

3.4

alert threshold

level beyond which there is a risk to human health from brief exposure and for which priority action is required

3.5

assessment

method used to measure, calculate, predict or estimate the level of a pollutant in the ambient air

3.6

authorities

3.6.1

local authority

local government department tasked with air quality management under the National Environmental Management: Air Quality Act

3.6.2

national authority

national authority responsible for air quality

3.6.3

provincial authority

provincial government department tasked with air quality management under the National Environmental Management: Air Quality Act

3.7

averaging period

period over which average value is determined

3.8

level

concentration of a pollutant in ambient air or the deposition thereof on surfaces over a given time

3.9

limit value

level fixed on the basis of scientific knowledge, with the aim of avoiding, preventing or reducing harmful effects on human health or the environment as a whole (or both), to be attained within a given period and not to be exceeded once attained

3.10

margin of tolerance

percentage of the limit value by which this value may be exceeded subject to the conditions laid down in this framework

3.11

pollutant

substance introduced directly or indirectly by man into the ambient air and likely to have harmful effects on human health or the environment as a whole (or both)

3.12

priority area

area identified and proclaimed as priority area by the Minister or any member of the executive committee (MEC), by notice in the Gazette and after consultation with relevant stakeholders, where she/he is of the opinion that:

- a) ambient air quality standards limits or values are being, or are likely to be exceeded; or
- b) any other harmful situation exists; and
- c) such exceedance or situation that the limits or values being exceeded are causing, or may cause, a significant negative impact on the environment or health.

3.12

target value

level fixed with the aim of avoiding more long-term harmful effects on human health and the environment as a whole, to be attained where possible over a given period

4 Adoption of a tiered approach to ambient air quality objectives

4.1 Multiple levels of air quality objectives

4.1.1 This framework supports the establishment and implementation of a system of multiple levels of air quality objectives including: limit values and associated time frames for attainment, target values and alert thresholds.

4.1.2 Limit values are to be based on scientific knowledge (taking into consideration local knowledge and conditions), with the aim of avoiding, preventing or reducing harmful effects on human health and the environment as a whole. Limit values are to be attained within a given period and are not to be exceeded once attained.

4.1.3 Target values are intended to avoid harmful long term effects on human health and the environment. Target values represent long term goals to be pursued through cost-effective progressive methods, and are frequently termed "long-term acceptable thresholds". At these values pollutants are either harmless to health and the environment, or unlikely to be reduced through expending further reasonable cost on abatement due to background sources or other factors.

4.1.4 Alert thresholds refer to levels beyond which there is an immediate risk to human health from brief exposure. The exceeded alert thresholds necessitate priority action.

4.2 Margins of tolerance

4.2.1 In order to take into account the actual levels of a given pollutant when setting limit values and the time needed to implement measures for improving the ambient air quality, the national authority may also make provision for temporary margins of tolerance. A margin of tolerance represents a percentage of the limit value by which this value may be exceeded subject to the conditions laid down in this framework (see figure 1).

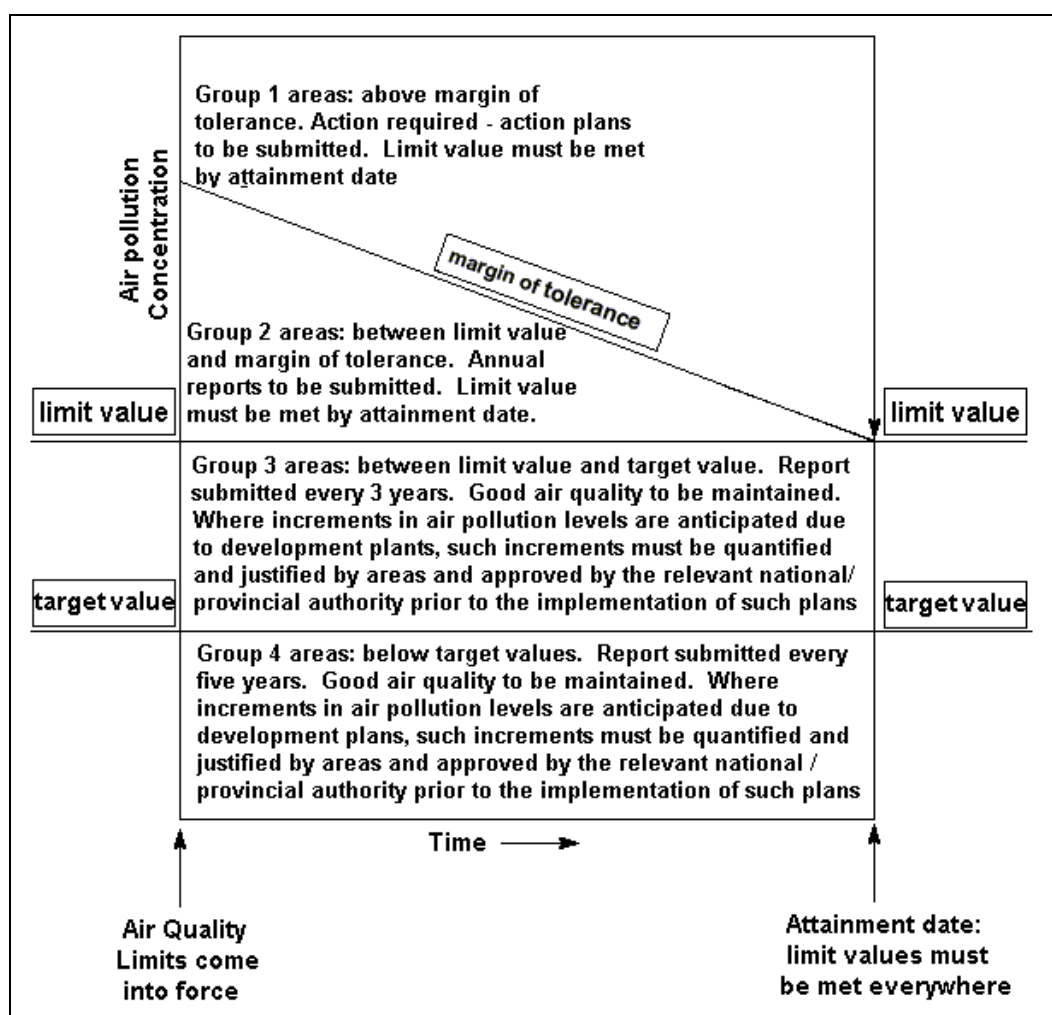


Figure 1 — Schematic diagram of how reporting frequency will relate to exceeded target values and limit values plus the margins of tolerance (assumed)

4.2.2 Reasonable progress should be made in the reduction of the margin of tolerance to reach zero on the date by which the limit value should be met. It is important to understand that concentrations do not necessarily have to be kept below the margin of tolerance when progress can only be achieved with reductions in steps taking longer than the gradient of the margin of tolerance time slope. Nor do they have to be reduced each year by the same amount as the margin of tolerance.

4.2.3 The purpose of the margin of tolerance is to identify areas with the worst air quality, namely group 1 areas in which the margin of tolerance is exceeded, and to distinguish between areas in which

air pollutant concentrations exceed the limit value but are within the margin of tolerance (group 2 areas) and areas in which concentrations are below limit values (group 3 areas). Air quality planning and reporting requirements are stipulated per group with more stringent requirements being devised for group 1 areas. A margin of tolerance is therefore not a derogation from a limit value, but rather provides a trigger for action in the period before the limit value should be met.

4.3 Long-term planning

The system of air quality objectives to be defined will explicitly link air pollution concentrations to appropriate air quality planning and remedial action over suitable time scales. Such a system emphasises that changes in ambient air quality take place over extensive periods, and that long term planning is more effective than corrective action aimed at instantaneous improvements in air quality.

4.4 Banded approach

The system of air quality objectives intended for implementation in South Africa is modelled on the tiered or banded approach applied by the European Community. The exceeding of thresholds therefore does not result in litigation, as in the US, but rather in the initiation of more intensive air quality management planning.

4.5 Progressive planning

The banded approach also encourages the management of air pollution down to lowest levels which can cost-effectively be met while compatible with sustainable development objectives, rather than only ensuring that pollution levels stay just below the threshold permitted by the standard. The process of continually improving air quality through progressive planning is much more beneficial than simple policing with penalties being issued when a standard is exceeded. However, during periods when air pollution concentrations peak resulting in a potential risk of serious and immediate damage to human health, the tiered or banded approach does make provision for dramatic action to be taken. Exceeding of such "alarm" or "alert" thresholds may therefore trigger appropriate actions until meteorological and other conditions have improved.

4.6 Target values

In order to take into account the specific formation mechanisms of ozone, these limit values and alert thresholds may need to be complemented or replaced by target values.

5 Supporting regulations and guidance documents

5.1 The national air quality standard setting process and the air quality management framework within which standards are to be implemented are illustrated in figure 2. A distinction is made in the figure between a national guideline, comprising primarily a limit value, and a national standard which includes various additional criteria, i.e. margins of tolerance, compliance time frames, permissible frequencies of exceeded values and reference to a national standard on ambient air quality monitoring for compliance assessment purposes.

All technical background documents supporting the rationale for the selection of limit values are required to undergo

a) peer review, and

b) stakeholder participation before completion.

5.2 Following the finalization of limit values, margins of tolerance, compliance time frames and permissible frequencies of exceeded values are established based on preliminary assessments undertaken for "priority areas" and agglomerations for the purpose of setting air quality standards.

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Such assessments aim to establish the ambient concentrations of the prioritized pollutants, and for areas where limit values are exceeded, serve to evaluate the:

- 1) technological feasibility;
- 2) economic feasibility;
- 3) social acceptability; and
- (4) strategic and political desirability of implementing measures to reduce and maintain air quality within limit values.

5.3 The consolidation of findings from the preliminary assessments (as described in clause 8) therefore provides the basis for setting air quality standards through the review of limit values, and the designation of appropriate margins of tolerance, compliance time frames and permissible frequencies of exceeded values. The procedure to be followed in undertaking such preliminary assessments is outlined in clause 8 and annex E.

NOTE Although limit values provide valuable guidance in assessing the acceptability of air quality, the setting and implementation of national standards is required for effective air quality management and planning.

5.4 Following the finalization of national air quality standards, such standards are to be implemented within an air quality management framework in which various management tools are to be implemented in an integrated manner. Such tools, including emissions inventory development and maintenance, air quality and meteorological monitoring and atmospheric dispersion modelling are to be applied for the purpose of characterizing temporal and spatial air pollutant concentrations, tracking progress made in reducing concentrations, and predicting future improvements made possible by implementing various pollution abatement measures. Pollution abatement measures are required to be subject to peer review and stakeholder consultation. In the setting of such measures the relevant authority shall take into account the

- a) technological feasibility,
- b) economic feasibility,
- c) social acceptability, and
- d) strategic and political desirability of implementing such measures.

5.5 Prior to the implementation of the air quality standards the following guidance reports and regulation needs to be in place:

- a) guidance report on air quality assessment under the framework for the setting and implementation of air quality objectives (see clause 9);
- b) guidance report on air quality management plan development and implementation; and
- c) national standard on ambient air quality assessment based on indirect methods.

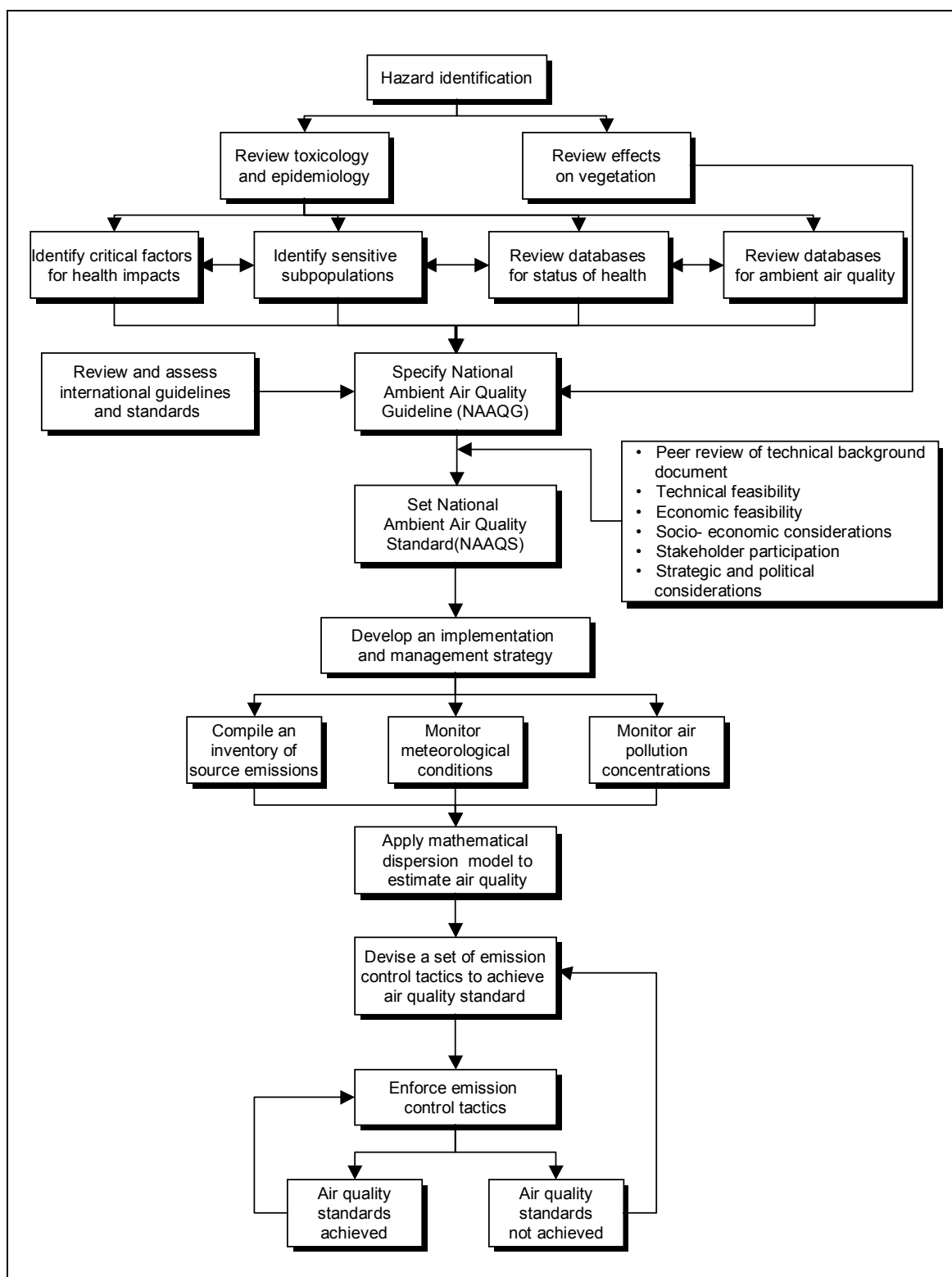


Figure 2 — Diagram illustrating the national standard setting and implementation process (after van Niekerk WA, 2001, *Technical Background Document for the Development of a National Ambient Air Quality Standard for Sulphur Dioxide*)

6 Implementation and responsibilities

For the implementation of this framework, the national authority shall designate at the appropriate levels the competent authorities and bodies responsible for:

- a) the implementation of this framework;
- b) the assessment of ambient air quality;
- c) the approval of the measuring devices (methods, equipment, networks, laboratories);
- d) ensuring the accuracy of measurement by measuring devices and checking the maintenance of such accuracy by those devices, in particular by internal quality controls carried out in accordance, inter alia, with the requirements of national quality assurance standards; and
- e) analysis of assessment methods.

7 Setting of the limit values and alert thresholds for ambient air

7.1 Setting

7.1.1 For those pollutants listed in annex A, limit values or target values (or both) should be interpreted as guideline values until the process outlined in this framework and its associated guidance reports for the setting of standards on the basis of such limit values has been finalized.

7.1.2 In fixing the limit values or target values (or both) and, as appropriate, alert thresholds, account shall be taken, by way of example, of the factors laid down in annex C. The limit values will initially be set to ensure the protection of human health. During the first review of the limit values such values should be revised to ensure the protection of human health and the environment as a whole.

7.1.3 Regarding ozone and similar photochemical or secondary pollutants, these proposals will take account of the specific formation mechanisms of this pollutant and, to this end, provision may be made for target values or limit values (or both). If a target value fixed for ozone is exceeded, the relevant local authority or the provincial authority (or both) shall inform the national authority of the measures taken in order to attain that value. On the basis of this information the national authority shall evaluate whether additional measures are necessary at national level.

7.1.4 For other pollutants, the national authority should evaluate the need for fixing limit values and, as appropriate, alert thresholds if, on the basis of scientific progress and taking into account the criteria laid down in annex C, it appears necessary to avoid, prevent or reduce the harmful effects of such pollutants on human health or the environment as a whole.

7.2 Resetting

The national authority shall be responsible, taking account of the most recent and relevant scientific research data in the epidemiological and environmental fields concerned and of the most recent advances in metrology, for re-examining at 5-year intervals the elements on which the limit values and alert thresholds referred to in 7.1 are based.

7.3 Criteria for setting

When limit values or target values (or both) and alert thresholds are set, criteria and techniques shall be established for:

- a) the measurement to be used in implementing the legislation referred to in 7.1, including

- 1) the location of the sampling points,
 - 2) the minimum number of sampling points, and
 - 3) the reference measurement and sampling techniques;
- b) the use of other techniques for assessing ambient air quality, particularly modelling, including
- 1) spatial resolution for modelling and objective assessment methods, and
 - 2) reference modelling techniques.

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

Future amendments to the measurement and modelling techniques may be necessary to adapt such techniques to scientific and technical progress. Such adaptation shall not have the effect of modifying the limit values or alert thresholds either directly or indirectly.

7.4 Consolidation of information

Information from preliminary air quality assessments to be undertaken for priority areas and agglomerations, as outlined in clause 8, shall be consolidated at a national level for the purpose of informing authorities of

- a) the time needed to implement measures for improving ambient air quality to within limit values;
- b) the setting of temporary margins of tolerances for specific limit values; and
- c) pollutant-specific procedures for the reduction of margins of tolerance in order to attain the level of the limit value at the latest at the end of the period determined for each pollutant.

7.5 Time frame

The provisions regarding time frames for achieving compliance with limit values and margins of tolerance shall be adopted by the national authority in accordance with the provisions laid down in this framework.

7.6 Measures taken by local or provincial authorities

7.6.1 Should a local or provincial authority take more stringent measures than those laid down in the provisions referred to in 7.5, it shall inform the national authority thereof and shall follow a consultative process and take into consideration the process and parameters as defined by this framework.

7.6.2 Should a local or provincial authority intend to set air quality objectives for pollutants not referred to in annex A, it shall inform the national authority thereof in sufficient time.

8 Preliminary assessment and standard finalization

8.1 Aims of preliminary assessment

A preliminary assessment shall be undertaken for priority areas (3.10) and agglomerations (3.2). The main aims of the preliminary assessment are

- a) to establish actual levels of the given pollutants based on representative measurements, surveys or assessment, and

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- b) for areas where actual levels of a given pollutant are above the limit values stipulated for that pollutant, to adequately assess the technological feasibility, economic viability, social acceptability and strategic and political desirability of implementing measures to reduce and maintain air quality within such limit values.

8.2 Procedure

The procedure to be followed in each area where actual levels of a given pollutant are above the limit values stipulated for a given pollutant, in consultation with relevant stakeholders, are as follows

- a) identification of major contributing sources to exceeded limit values,
- b) identification of emission reduction measures and associated time frames for their implementation suited to reducing contributions from major sources,
- c) assessments of the technical feasibility, economic viability and social acceptability of emission reduction measures,
- d) determination of the feasibility of emission reduction measures given strategic and political considerations,
- e) identification of emission reduction measures which are
 - 1) fair, taking into account the contribution of sources,
 - 2) technically feasible,
 - 3) economically viable, and
 - 4) socially, strategically and politically acceptable, and
- f) prediction of time frames for aligning air quality with limit values by the implementation of feasible combinations of emission reduction measures.

8.3 Completion of assessment and reports

The preliminary assessments are to be completed and reports submitted to the national authority within an agreed timeframe after the adoption of this framework and the limit value regulations have been issued. Each preliminary assessment will be subject to a peer review, as outlined in the criteria given in annex E.

The reviewed preliminary assessments will be used by the national authority to determine suitable national compliance time frames, margins of tolerance and permissible frequencies of exceeded values. Draft components will be subject to a technical peer review and will undergo a process of stakeholder consultation prior to finalization.

8.4 National standards

Following the finalization of the national standards a cost-benefit analysis will be undertaken to quantify, nationally, the implications of implementing national standards.

9 Assessment of ambient air quality

Once time frames for achieving compliance with limit values have been set, ambient air quality shall be assessed in all priority areas and agglomerations, in accordance with the criteria set out in the relevant standard (SANS 1929).

10 Improvement of ambient air quality

10.1 Local authorities shall take the necessary measures to ensure compliance with air quality standards, in consultation with relevant stakeholders.

10.2 Measures taken in order to achieve the aims of this framework shall

- a) take into account an integrated approach to the protection of air, water and soil,
- b) not contravene national legislation on the protection of safety and health of workers at work, and
- c) have no significant negative effects on human health and the environment as a whole in other areas.

10.3 Local authorities shall draw up action plans indicating the measures to be taken in the short term where there is a risk of the limit values or alert thresholds (or both) being exceeded, in order to reduce the risk, and to limit the duration, of such an occurrence. (Such plans may, depending on the individual case, provide for measures to control and, where necessary, suspend activities, including motor-vehicle traffic, which contribute to the limit values being exceeded.)

11 Measures applicable in areas where levels are higher than the limit value

11.1 The national authority shall draw up a list of areas, including agglomerations, in which the levels of one or more pollutants are higher than the limit value plus the margin of tolerance.

Where no margin of tolerance has been fixed for a specific pollutant, areas and agglomerations in which the level of that pollutant exceeds the limit value shall be treated in the same way as the areas and agglomerations referred to in 11.1, 11.3, 11.4 and 11.5 shall apply to them.

11.2 The national authority shall draw up a list of zones and agglomerations in which the levels of one or more pollutants are between the limit value and the limit value plus the margin of tolerance.

11.3 In the areas and agglomerations referred to in 11.1, local authorities shall take measures to ensure that a plan or programme is prepared or implemented for attaining the limit value within the specific time limit. The said plan or programme, which shall be made available to the public, shall incorporate at least the information listed in annex D.

NOTE The Draft National Air Quality Management Bill (revision 7) makes provision for every local authority to integrate Air Quality Management Plans into their Integrated Development Plans.

11.4 In the areas and agglomerations referred to in 11.1, where the level of more than one pollutant is higher than the limit values, local authorities shall provide an integrated plan that covers all the pollutants concerned.

11.5 National and provincial authorities shall regularly check the implementation of the plans or programmes submitted under 11.3 by examining their progress and the trends in air pollution.

11.6 When the level of a pollutant exceeds, or is likely to exceed, the limit value plus the margin of tolerance or, as the case may be, the alert threshold following significant pollution originating in another local authority's jurisdiction, the local authorities concerned shall consult with one another via the provincial authority(ies) with a view to finding a solution. The national authority may be present at such consultations and relevant stakeholders will be consulted.

11.7 Provincial and local authorities may motivate for the designation of specific zones within which limit values for a specific pollutant are exceeded owing to the concentrations of that pollutant in

ambient air due to natural sources. In such instances such authorities shall provide to the national authority with

- a) information on concentrations and sources of the specific pollutant that contributes to concentrations of the pollutant in the zone, and
- b) the necessary justification to demonstrate that any exceeded limit values are due to natural sources.

Within such zones provincial and local authorities shall be obliged to implement action plans in accordance with the *Guideline report on air quality management plan development* and Implementation only where the limit values laid down are exceeded owing to man-made emissions.

12 Requirements in areas where the levels are lower than the limit value

The national authority shall draw up a list of areas and agglomerations in which the levels of pollutants are below the limit value, i.e. group 3 and 4 areas depicted in figure 1.

Local authorities shall maintain the levels of pollutants in these areas and agglomerations below the limit value and shall endeavour to preserve the best ambient air quality compatible with sustainable development. Where increments in air pollutant concentrations are anticipated due to proposed development plans, such increments shall be quantified and justified by local authorities and approved by the relevant national or provincial authority (or both) before the adoption and implementation of such plans.

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

Local authorities shall undertake to ensure that the necessary processes and steps are in place and are implemented to inform the public (for example, by means of radio, television and the press) when alert thresholds are exceeded. Local authorities shall also forward to national and provincial authorities, on a provisional basis, information concerning the levels recorded and the duration of the episode(s) of pollution no later than three months following their occurrence. A list of minimum details to be supplied to the public together with the alert thresholds shall be drawn up by national authorities (see annex D).

14 Transmission of information and reports

14.1 Priority areas and agglomerations in which the levels of one or more pollutants are higher than the limit value plus the margin of tolerance, or are higher than the limit value where no margin of tolerance is specified, shall

- a) inform national or provincial authorities (or both) of the occurrence of levels exceeding the limit value plus the margin of tolerance, of the dates or periods when such levels were observed and the values recorded in the nine-month period after the end of each year,
- b) inform national or provincial authorities (or both) of the reasons for each recorded instance, in the nine-month period after the end of each year,
- c) send to national or provincial authorities (or both) the plans or programmes referred to in 11.3 no later than eighteen months after the end of the year during which the levels were observed, and

- d) inform the national or provincial authorities (or both) every three years of the progress of the plan or programme.

14.2 The national authority shall publish

- a) annually, a list of the areas and agglomerations in which the levels of one or more pollutants are higher than the limit value plus the margin of tolerance, or are higher than the limit value where no margin of tolerance is specified, and
- b) every three years, a report on the ambient air quality in the country.

Annex A (informative)

List of initial atmospheric pollutants

The following atmospheric pollutants are to be taken into consideration initially for the national standard setting and implementation process:

- a) Sulfur dioxide (SO_2);
- b) Nitrogen dioxide (NO_2);
- c) Carbon monoxide (CO);
- d) Benzene (C_6H_6);
- e) Lead;
- f) Dust deposition;
- g) Particulate matter (PM_{10}); and
- h) Ozone (O_3).

Annex B (informative)

Factors to be taken into account when setting limit values and alert thresholds

When setting the limit value and, as appropriate, alert threshold, the following factors can, by way of example, be taken into account (with the prevailing factor being human health):

- a) degree of exposure of sectors of the population, and in particular sensitive sub-groups;
- b) climatic conditions and meteorology;
- c) sensitivity of flora and fauna and their habitats;
- d) historic heritage exposed to pollutants; and
- e) long-range transmission of pollutants, of which secondary pollutants, include ozone and particulate matter.

Annex C (informative)

Guidelines for selecting air pollutants for consideration

C.1 Possibility, severity and frequency of effects; with regard to human health and the environment as a whole, the irreversible effects should be of special concern.

C.2 Ubiquity and high concentration of the pollutant in the atmosphere is a consideration in selecting an air pollutant.

C.3 Environmental transformations or metabolic alterations, as these alterations may lead to the production of chemicals with greater toxicity.

C.4 Persistence in the environment, particularly if the pollutant is not biodegradable and can accumulate in humans, the environment or food chains.

C.5 Impact of the pollutant:

- a) consider the size of exposed population, living resources or ecosystems; and
- b) the existence of particularly sensitive targets in the zone concerned.

C.6 Risk-assessment methods can also be used.

Annex D
(informative)

Information to be included in the local, regional or national programmes for improvement in the ambient air quality

D.1 Localization of excess pollution:

- a) region;
- b) city (map); and
- c) measuring station (map, geographical coordinates).

D.2 General information:

- a) type of zone (city, industrial or rural area);
- b) estimate of the polluted area (in square kilometres) and of the population exposed to the pollution;
- c) useful climatic data;
- d) relevant data on topography; and
- e) sufficient information on the type of target that requires protection in the zone.

D.3 Responsible authorities

This entails names and addresses of persons responsible for the development and implementation of improvement plans.

D.4 Nature and assessment of pollution concentrations observed over previous years (before the implementation of the improvement measures):

- a) concentrations measured since the beginning of the project; and
- b) techniques used for the assessment.

D.5 Origin of pollution:

- a) list of the main emission sources responsible for pollution (map);
- b) total quantity of emissions from these sources (tonnes/year); and
- c) information on pollution imported from other regions.

D.6 Analysis of the situation:

- a) details of those factors responsible for the excess (transport, including cross-border transport, formation); and
- b) details of possible measures for improvement of air quality.

D.7 Details of those measures or projects for improvement which existed prior to the entry into force of this framework i.e.

- a) local, regional, national, international measures; and
- b) observed effects of these measures.

D.8 Details of those measures or projects adopted with a view to reducing pollution following the entry into force of this framework:

- a) listing and description of all the measures set out in the project;
- b) timetable for implementation; and
- c) estimation of the improvement of air quality planned and of the expected time required to attain these objectives.

D.9 Details of the measures or projects planned or being researched for the long term.

D.10 List of the publications, documents, work, amongst other, used to supplement information requested in this annex.

Annex E (informative)

Criteria for preliminary assessments undertaken within priority areas and agglomerations

E.1 Preliminary assessments

Preliminary assessments are required to be undertaken within priority areas and agglomerations to inform the revision of limit values and the setting of margins of tolerance, compliance time frames or permissible frequencies of exceeded limit values (or both). Such assessments shall, firstly, establish actual levels of the given pollutants based on representative measurements, surveys or assessments.

For areas where actual levels of a given pollutant are above the limit values stipulated for that pollutant, the preliminary assessment is required to undertake the following:

- a) **establish source contributions** to ambient air concentrations of the pollutant of concern;
- b) **characterize future trends in ambient air concentrations** of the pollutant of concern given a "business as usual" scenario;
- c) **identify emission reduction measures** suited to reduce contributions from major sources and associated time frames for implementation;
- d) assess **the environmental benefit of measures** to reduce and maintain air quality within limit values;
- e) determine the **technical feasibility of measures** to reduce and maintain air quality within limit values;
- f) evaluate the **economic viability of measures** to reduce and maintain air quality within limit values;
- g) assess the **social acceptability and political desirability of measures** to reduce and maintain air quality within limit values;

- h) **prioritize emission reduction measures** on the basis of their environmental benefits, technical feasibility, economic viability, social acceptability and political desirability; and
- i) **determine the time required to reduce air pollutant concentrations to within the limit value** taking into account the implementation of prioritized emission reduction measures.

The minimum requirements to be met in undertaking the above tasks are outlined in E2 to E11. Preliminary assessments are required to include a consultative process with interested and affected parties being engaged at relevant stages of the assessments.

E.2 Procedure for assessing air quality and establishing source contributions

E.2.1 Air quality can be assessed in one of three ways:

- a) directly through the acquisition and analysis of suitable air pollution monitoring data; or
- b) indirectly through the application of emissions inventory and atmospheric dispersion modelling, or
- c) by using a combination of monitoring, emissions inventories and dispersion modelling.

The third approach is preferred.

E.2.2 In the use of air quality monitoring data it shall be ensured that these data adequately reflect the highest air pollution concentrations occurring in the region under assessment. Aforementioned concentrations refer to the highest air pollution concentrations across areas where air quality standards are applicable, i.e. outdoors, excluding work places, where exposures of sensitive receptors occur or can occur. The air pollution monitoring data set shall also comply with the following minimum requirements:

- a) air pollution concentrations for all averaging periods for which limit values are given shall be available for assessment (for example, 10-minute averages, 1-hour averages; 8-hour averages; 24-hour averages; annual averages);
- b) the data shall enable the assessment of possible diurnal, seasonal and where possible inter-annual variations in the concentrations of the air pollutant of interest (five years or more of data is preferred for the assessment of inter-annual variations);
- c) meet the data quality objectives given in the national standard applicable to the air pollutant of interest; and
- d) uncertainties related in a monitoring method should be explicitly stated.

E.2.3 In the use of emissions inventory establishment in combination with atmospheric dispersion modelling, the following minimum requirements shall be met:

- a) the emissions inventory shall list and quantify emissions from all major sources of the air pollutant of interest;
- b) source parameters required for dispersion modelling shall be included in the emissions inventory and temporal trends in emissions accounted for;
- c) the atmospheric dispersion model used shall be applicable to the local environment and the configuration of the sources to be simulated;
- d) representative meteorological, terrain and land use data should be used as input in the dispersion simulations with at least one year of meteorological data (preferably five years of data) being used as input; and

- e) uncertainties related in emission estimation, dispersion simulation and the presentation of results should be explicitly stated.

E.2.4 The relative contribution of sources could be assessed on the following bases:

- a) contribution of individual sources to total emissions,
- b) contribution of individual sources to ambient air pollutant concentrations, and
- c) contribution of sources to human and environmental risks.

The first approach requires that an emissions inventory be undertaken. The second approach necessitates the use of an emissions inventory in combination with atmospheric dispersion modelling or receptor modelling, or both. The third approach requires the use of emissions inventories and dispersion modelling together with exposure and risk assessment tools. For the purpose of preliminary assessments it is recommended that source contributions be determined, as a minimum, on the basis of the second approach although the third approach is recognized as being preferred.

E.2.5 In order for the assessment of ambient air quality based on measurements made within various parts of South Africa to be comparable, the location and number of sampling points and reference methods of measurement used should be specified when values are set for alert thresholds, and limit and target values.

To allow for the use of other techniques of estimation of ambient air quality besides direct measurement, it is necessary to define the criteria for use and required accuracy of these techniques.

E.3 Characterization of future trends in air pollutant concentrations given "business as usual"

Driving forces responsible for changes in the extent of atmospheric emissions from major source sectors need to be identified. Population growth within informal settlements has, for example, been identified as contributing to increased household fuel burning in certain areas. Other indicators which could influence atmospheric emissions and therefore air quality trends include: energy-use patterns, vehicle population, industrial and mining growth rates and waste generation per capita, among others.

Following the identification and evaluation of the driving forces applicable to the major contributing sources, emission projections and resultant ambient air quality trend predictions should be undertaken for a "business as usual" scenario. This scenario refers to the absence of additional emission reduction measures being implemented.

E.4 Emission reduction measure identification

Options and interventions which may be implemented to reduce atmospheric emissions or the impact of such emissions on air quality from the major contributing sources should be identified. Such interventions could include technological options, legislative and regulatory tools, market interventions, education and awareness programmes or a combination of such options.

Options and interventions for which no fatal flaws exist with regard to their environmental benefits, technical feasibility and socio-economic acceptability should be prioritized for quantitative assessment.

E.5 Criteria for assessing the environmental benefits of measures

Emission reduction or air quality improvements which may be realised through the implementation of interventions or packages of interventions should be quantified through the use of emissions inventory and dispersion modelling tools. The minimum requirements given for the use of these tools in E.2.3 are applicable.

Improvements in various human health endpoints (for example, cancer risks, hospital admissions, cough, mortality) due to the implementation of the intervention or a package of interventions may be quantified through the application of dose-response relationships published by organizations such as the World Health Organization (WHO), Health Canada among others. Environmental benefits, such as increased crop productivity and reduced material damage, may similarly be quantified where dose-response relationships exist which are applicable to local environments.

The quantification of health and environmental impact reductions due to air quality improvements associated with the implementation of interventions enables the costing of health and environmental benefits during the economic assessment.

E.6 Criteria for assessing the technical feasibility of measures

Interventions shall be shown to be technically feasible on the basis of the availability of the knowledge, expertise and technology required for the development and implementation of the intervention.

E.7 Criteria for assessing the socio-economic viability of measures

In assessing the socio-economic impacts of each option the following aspects will need to be addressed:

- a) capital and operational costs associated with intervention implementation, noting the sector which will be responsible for such costs;
- b) financial benefits associated with anticipated air quality improvements;
- c) implications of intervention implementation in terms of the provision of employment and services, the ability to meet basic needs;
- d) impact on the economy of the region and on potential investment in the region; and
- e) acceptability of intervention to interested and affected parties.

E.8 Criteria for assessing the political feasibility of measures

Attention is required to be given to key strategic and political considerations to determine the feasibility of proposed interventions. Such considerations include national, provincial and local policy, legislation and regulations, and strategic policies and plans having been developed for the region or for a particular sector.

E.9 Prioritization of emission reduction measures

Emission reduction measures which meet the following criteria should be identified and prioritized for implementation:

- a) measures which are fair, taking into account the relative contribution of sources to ambient air;
- b) pollutant concentrations in the areas of concern;
- c) technically feasible;
- d) economically viable; and
- e) socially, strategically and politically acceptable.

E.10 Determination of time frames for attaining compliance with limit values

Time frames for enabling air quality to comply with limit values due to the implementation of the selected interventions should be predicted through the use of emission projections and atmospheric

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dispersion modelling. The minimum requirements given for the use of these tools in E.2 are applicable.

E.11 Peer review of preliminary assessments

Preliminary assessments should be subject to peer review prior to the use of the findings of such assessments for the purpose of informing the setting of ambient air quality objectives or their related criteria (for example, compliance time frames, margins of tolerance, permissible frequencies by which the values and thresholds **may be** exceeded).

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