

1 Introduction

In Article 5 of the EU Framework Directive 96/62/EC on ambient air quality assessment and management the following obligatory requirements are laid down: "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 for implementation of the legislation..."

This report contains the results of the "Preliminary assessment of ambient air quality in Cyprus" and recommendations for the implementing agencies to decide on the network to be established for the systematic monitoring of air quality in accordance to the relevant EU Directives.

1.1 Project Objectives and Overview

The main objectives of this project are:

- "Preliminary Assessment of Ambient Air Quality and Drawing Up of Zones of Pollution in Cyprus" according to the EU Framework Directive 96/62/EC on ambient air quality assessment and management.
- To assist Cyprus to optimise the ambient air quality monitoring network in order to comply with the relevant Directives of the European Union including the reporting to the commission.
- To supply the necessary input for the formulation of air pollution management policies in Cyprus including preparation of plans on how to meet the EU limits and other EU requirements.
- To increase public awareness on the issues of urban and rural air pollution.

Needs Assessment

The recommended international method, to obtain accurate initial urban, rural and background level concentrations of the island in a relatively short period, is through the use of the diffusive sampling technique. This sampling should be accompanied by continuous air quality reference measurements and the determination of meteorological conditions.

Based on the results of the measurements, the complete spatial distribution of pollutants should be calculated using modelling methods.

Tasks

The air pollutants dispersion from the emission sources and their distribution in the atmosphere in time and space depends on several parameters. They are depicted in Figure 1.1. In this figure the way of pollutants from the emission to the receptors (humans, vegetation, materials) and the air quality management from monitoring to air pollution prevention measures is also shown in this Figure.

To reach the objectives of the project, to determine the temporal and the spatial distribution of the air pollutants and the assessment of its results, the total volume of work is broken down in the following main tasks:

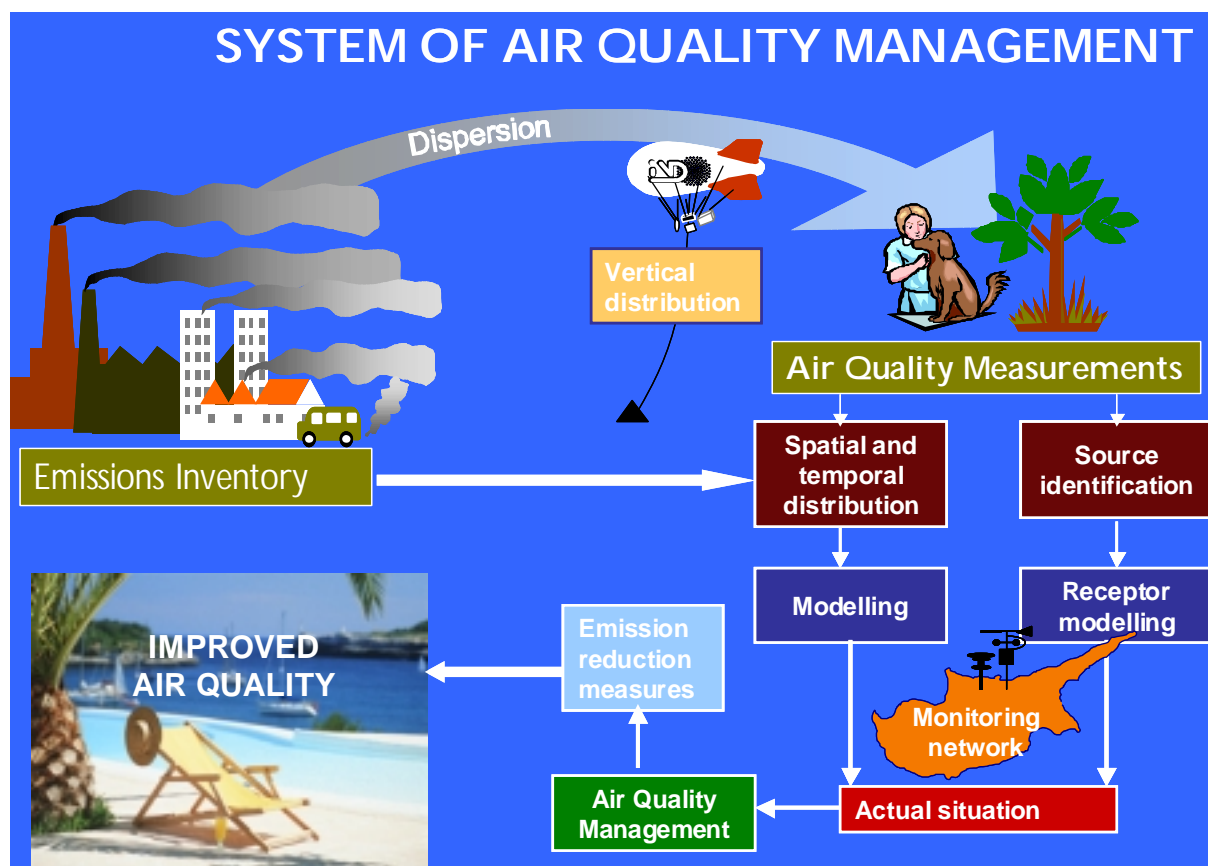


Figure 1.1. General overview of air quality assessment and management

- Task 1: Emissions Inventory
- Task 2: Measurements of Pollutants in Different Zones of Cyprus Using Diffusive and Active Sampling Techniques and Continuous Reference Measurements
- Task 3: Determination of Pollutants Transport by Measuring the Vertical Structure of the Pollutant Plume of Nicosia and Limassol and Continuous Ground Level Wind Measurements
- Task 4: Calculation of Complete Concentration Fields Over the Republic of Cyprus Using Measurement Results and Modelling
- Task 5: Overall Evaluation and Recommendations Using the Results of Measurements and Modelling
- Task 6: Future Air Quality Monitoring Network for Cyprus
- Task 7: Training of the Governmental Staff, Presentation and Discussion of the Results

1.2 Legislation and assessment methods applied

The evaluation of the measurement results follows the regulations laid down in the framework directive 96/62/EC and its daughter guidelines 1999/30/EC, 2000/69/EC and 2002/3/EC from the European Commission, called 1st, 2nd and 3rd daughter directives.

As a matter of principle for the evaluation limit values have been assigned for each pollutant component. The limit values set in the guidelines have to be fulfilled by the member states by the year 2010 (respectively by 2005 for some parameters). To fulfil the requirement, different margin tolerances for each component and based on different averaging periods are formulated to gradually reduce the prevalent concentration levels by an equal annual percentage until 2010 over the period of time since the entering into force of the directives.

Table 1.1 and 1.2 give a general overview on the limit value presently valid.

Table 1.1. Limit values for SO₂, NO₂, NO_x, CO and PM₁₀ according to 1st and 2nd daughter guidelines

component	averaging period	limit value	tolerance margin	year ¹⁾
sulphur dioxide SO ₂	1 hour ²⁾	350 µg/m ³	43 %	2005
	24 hours ²⁾	125 µg/m ³	-	2005
	calendar year and winter ³⁾	20 µg/m ³	-	2001
nitrogen dioxide NO ₂	1 hour ²⁾	200 µg/m ³	50%	2010
	calendar year ²⁾	40 µg/m ³	50%	2010
nitrogen oxides NO _x	calendar year ⁴⁾	30 µg/m ³	-	2010
carbon monoxide CO	8 hours _{max} ²⁾	10 mg/m ³	2 mg/m ³ ⁵⁾	2005
particulate matter PM ₁₀	24 hours ²⁾	50 (50) µg/m ³	50 (0)	2005 (2010)
	1 year ²⁾	40 (20) µg/m ³	20 (20)	2005 (2010)

¹⁾ ... year when the limit values have to be met

²⁾ ... limit value for protection of human health

³⁾ ... limit value for protection of ecological systems., winter period 1 October to 31 March

⁴⁾ ... limit value for protection of the vegetation

⁵⁾ ... 6 mg/m³ on 13 December, reducing on 1 January 2003 and every 12 months thereafter by 2 mg/m³ to reach 0 % by 1 January 2005

Table 1.2. Limit values for O₃ according to 3rd daughter guideline (have to be reached in 2010):

	averaging period	value
target value	8 hours _{max} ¹⁾	120 µg/m ³
	AOT40 ²⁾	18.000 µg/m ³ *h
long-term target value	8 hours _{max} ³⁾	120 µg/m ³
	AOT 40 ⁴⁾	6.000 µg/m ³ *h
information threshold	1 hour	180 µg/m ³
alarm threshold	1 hour ⁴⁾	240 µg/m ³

¹⁾ ... for the protection of human health

²⁾ ... for the protection of the vegetation; AOT40 means the sum of the difference between hourly concentrations greater than 80 µg/m³ and 80 µg/m³ over a given period using only the 1 hour values measured between 8:00 and 20:00 CET each day.

³⁾ ... long-term objective within a calendar year for the protection of human health

⁴⁾ ... long-term objective within a calendar year for the protection of the vegetation

The **tolerance margin** gives the percentage of the limit value by which this value may be exceeded subject to the conditions laid down in the frame Directive. All limit values for the different components have to be met in 2010 (2005), which means that the maximum allowed value is reduced consecutively by an equal annual percentage until it matches the limit value in 2010 (2005).

The measurement areas are classified according to article 2 of the framework directive 1996/62/EC. To determine with which strategy measurements have to be carried out, assessment thresholds have been established. These levels are specified for each component. The upper assessment threshold specifies the level below which modelling or objective estimation and modelling techniques may be used to assess ambient air quality. The lower assessment threshold specifies the level below which modelling or objective estimation and modelling techniques alone may be used to assess ambient air quality. The classification of the ambient air quality by both upper and lower assessment threshold has to be in accordance with article 6 of the framework directive.

Table 1.3 shows the assessment thresholds determined for SO₂, NO_X, CO according to EU guidelines:

Tab. 1.3. Upper and lower assessment thresholds for SO₂, NO₂, NO_x, CO and PM₁₀ determined on basis of limit values valid in 2010 (2005):

component	averaging period	assessment threshold (percentage of limit value)		exceedence frequency per year
		upper	lower	
sulphur dioxide SO ₂	24 hour	75 µg/m ³ (60%)	50 µg/m ³ (40%)	3 times each
nitrogen oxides NO _x	1 hour	140 µg/m ³ (70%)	100 µg/m ³ (50%)	18 times each
NO ₂	1 year ¹	32 µg/m ³ (80%)	26 µg/m ³ (65%)	-
NO _x	1 year	24 µg/m ³ (80%)	19,5 µg/m ³ (65%)	-
carbon monoxide CO	8 hours _{max}	7 mg/m ³ (70%)	5 mg/m ³ (50%)	-
Particulate matter PM ₁₀	24 hours	30 µg/m ³ (60%)	20 µg/m ³ (40%)	7
	1 year	14 µg/m ³ (70%)	10 µg/m ³ (50%)	-

The limit value for 1.1.2003 is calculated on basis of the margin tolerance (Table 1.4). It is calculated as total of limit value for 2010 and the corresponding margin of tolerance as of 1.1.2003 according to the Annexes I and II of the 1st daughter guideline.

Table 1.4. Limits including tolerance margin for 1.1.2003

	NO ₂	SO ₂	PM ₁₀
Limit value 1.1.2003	54 µg/m ³	20 µg/m ³ ²⁾	75 µg/m ³
Limit value in 2010	40 µg/m ³	(20 µg/m ³ valid since 19 July 2001)	50 µg/m ³
upper assessment threshold	32 µg/m ³	12 µg/m ³ ²⁾	14 µg/m ³
lower assessment threshold	26 µg/m ³	8 µg/m ³ ²⁾	10 µg/m ³
lower assessment threshold for vegetation ¹⁾	19,5 µg/m ³	-	-

¹⁾ ... only valid for rural areas: NO₂ = NO_x

²⁾ ... limit value for the protection of ecosystems and calculated on calendar year and winter basis

The margin of tolerance is a new concept in legislation on air quality. Despite its name it is not a derogation from a limit value. It provides a trigger for action in the period before the limit value must be met.

As Figure 1.1 shows, the margin of tolerance is added to the limit value when the legislation setting the limit value comes into force. It is reduced each year to reach zero on the date by which the limit value must be met. It is important to understand that concentrations do not have to be kept below the margin of tolerance. Nor do they have to be reduced each year by the same amount as the margin of tolerance. The purpose of the margin of tolerance is simply to identify the zones with the worst air quality (Group 1 of Figure 2). Member States must prepare detailed action plans for these areas showing how the limit value will be met by the attainment date. These action plans must be made available to the public and sent to the Commission, which will monitor progress.

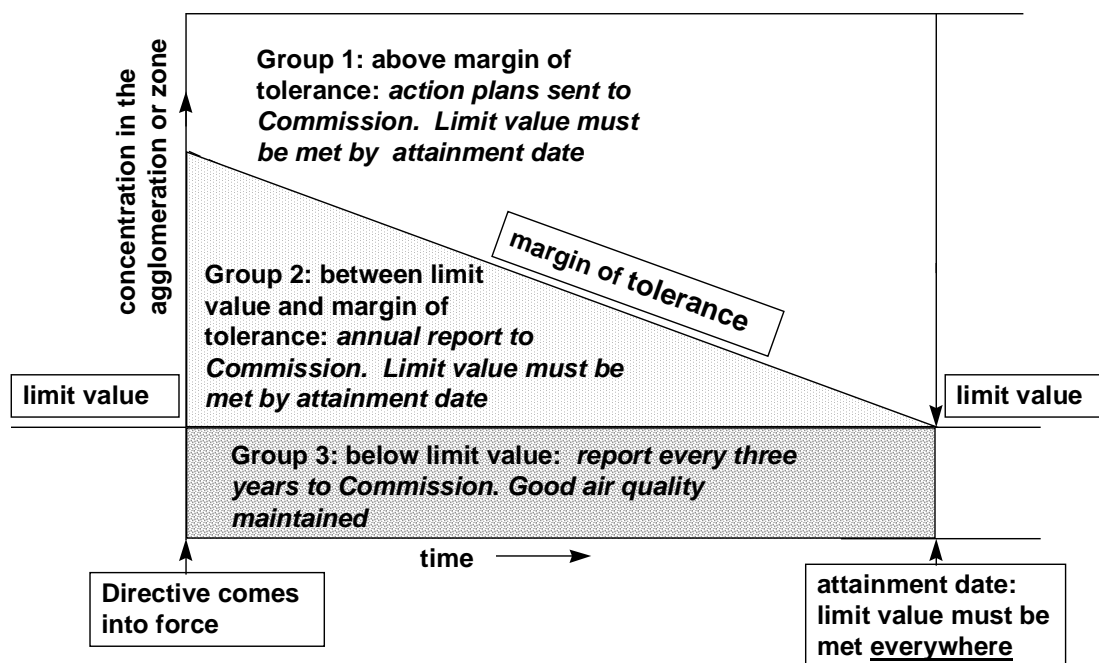


Figure 1.1. Schematic diagram of how reports to the Commission relate to exceedence of the limit value plus the margin of tolerance

Zones where maximum pollution levels are between the limit value and the limit value plus margin of tolerance (Group 2) are not required to forward detailed action plans to the Commission. But they must report concentrations annually to the Commission and must take any necessary steps to ensure that the limit value is met by the attainment date.

Member States' obligation therefore is to ensure that all zones with concentrations above the limit value during the period before the attainment date reach the limit value by the attainment date. The Commission will publish every year a list of the zones above the limit value plus the margin of tolerance, and zones above the limit value.