AMBIENT CONCENTRATION OF AIR POLLUTANTS IN URBAN AREAS		
Atmosphere	**Air Quality**	**Core indicator**

1. INDICATOR

(a) Name: Ambient concentration of air pollutants in urban areas.

(b) Brief Definition: Ambient air pollution concentrations of ozone, particulate matter ($PM_{10,}$ and $PM_{2,5}$, if those are not available: SPM, black smoke), sulphur dioxide, nitrogen dioxide, lead. Additional: carbon monoxide, , volatile organic compounds including benzene (VOCs). The priority is collection of the indicator in large cities (over 1 million population).

(c) Unit of Measurement: $\mu g/m^3$, ppm or ppb, as appropriate;

(d) Placement in the CSD Indicator Set: Atmosphere/Air Quality.

2. POLICY RELEVANCE

(a) Purpose: The indicator provides a measure of the state of the environment in terms of air quality and is an indirect measure of population exposure to air pollution of health concern in urban areas.

(b) Relevance to Sustainable/Unsustainable Development (theme/sub-theme): An increasing percentage of the world's population lives in urban areas. High population density and the concentration of industry exert great pressures on local environments. Air pollution, from households, industry power stations and transportation (motor vehicles), is often a major problem. As a result, the greatest potential for human exposure to ambient air pollution and subsequent health problems occurs in urban areas. Improving air quality is a significant aspect of promoting sustainable human settlements.

The indicator may be used to monitor trends in air pollution as a basis for prioritising policy actions; to map levels of air pollution in order to identify hotspots or areas in need of special attention; to help assess the number of people exposed to excess levels of air pollution; to monitor levels of compliance with air quality standards; to assess the effects of air quality policies; and to help investigate associations between air pollution and health effects.

(c) International Conventions and Agreements: None.

(d) International Targets/Recommended Standards: World Health Organization (WHO) air quality guidelines exist for all the pollutants of this indicator. Many countries have established their own air quality standards for many of these pollutants.

(e) Linkages to Other Indicators: This indicator is closely linked to others which relate to causes, effects, and societal responses. These include, for example, the indicators on population growth rate, rate of growth of urban population, percent of population in urban areas, annual energy consumption per capita, emissions of sulphur oxides and nitrogen oxides, life expectancy at birth, total national health care as a percent of Gross National Product, share of consumption of renewable energy resources, environmental protection expenditures as a percent of Gross Domestic Product, expenditure on air pollution abatement, childhood morbidity due to acute respiratory illness, childhood mortality due to acute respiratory illness, capability for air quality management, and availability of lead-free gasoline.

3. METHODOLOGICAL DESCRIPTION

(a) Underlying Definitions and Concepts: The indicator may be designed and constructed in a number of ways. Where monitored data are available, it is usefully expressed in terms of mean annual or percentile concentrations of air pollutants with known health effects – e.g., ozone, carbon monoxide, particulate matter ($PM_{10,}$ $PM_{2,5}$, SPM), black smoke, sulphur dioxide, nitrogen dioxide, volatile organic compounds including benzene (VOCs) and lead – in the outdoor air in urban areas.
Where monitoring data are unavailable, estimates of pollution levels may be made using air pollution models. Dispersion models, however, depend on the availability of emission data; where these are not available, surveys may be conducted using rapid source inventory techniques. Because of the potential errors in the models or in the input data, results from dispersion models should ideally be validated against monitored data.

(b) Measurement Methods: Suitable air monitors must fulfil several requirements, such as detection limits, interferences, time resolution, easy operation and of course, cost. There are several good references in the literature or available at agencies on air monitoring and analysis from where information can be obtained. It is important, however, to refer to the published scientific literature for the most appropriate and recent air monitoring methods.
A number of models are available for estimation of ambient concentration of air pollutants. Most of them are founded on the Gaussian air dispersion model.

(c) Limitations of the Indicator: Measurement limitations relate to detection limits, interferences, time resolution, easy operation, and cost. Evaluation of the accuracy of model results is critical before relying on model output for decision-making.

(d) Status of the Methodology: The methodology is widely used in many developed and developing countries.

(e) Alternative Definitions: None.

4. ASSESSMENT OF DATA

(a) Data Needed to Compile the Indicator: Data must be time and spatially representative concentrations such as, for example, mean annual concentrations (mean concentrations of the pollutant of concern, averaged over all hours, or days, of the year) or percentile concentration (concentration of the pollutant of concern exceeded in 100-X% of hours/days, where X is the percentile as defined by the relevant standards). In addition, information must be available on site location and type (e.g., industrial, transport oriented or residential area).

(b) National and International Data Availability and Sources: Data on ambient air pollution concentrations is often routinely collected by national or local monitoring networks. Data is often also collected for research purposes by universities and research institutes. In addition, industry collects many data.

(c) Data References: Data on ambient air pollution can be obtained from national and local monitoring networks. Sometimes, data is available from universities, research institutes and industry. In addition, a growing volume of data can be obtained from international sources such as the European Environmental Agency.

5. AGENCIES INVOLVED IN THE DEVELOPMENT OF THE INDICATOR

(a) Lead Agency: The lead agency is the World Health Organization (WHO). The contact point is the Director, Department for the Protection of the Human Environment; fax no. (41 22) 791 4159.

(b) Other Contributing Organizations: The United Nations Environment Programme.

6. REFERENCES

(a) Readings:

WHO (2000) *Air Quality Guidelines for Europe, Second Edition. WHO Regional Publications, European Series, No. 91*

WHO (2000) *Human Exposure Assessment*, Environmental Health Criteria Document 214, Programme of Chemical Safety.

WHO (2000) *Decision-Making in Environmental Health: From Evidence to Action*, edited by C. Corvalan, D. Briggs and G. Zielhuis, E & FN Spon, London, New York.

WHO (1999) *Monitoring Ambient Air Quality for Health Impact Assessment*, WHO Regional Publications, European Series, No. 85.

WHO (1999) *Environmental Health Indicators: Framework and Methodologies*. Prepared by D. Briggs, Occupational and Environmental Health.

WHO (2006) WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide. Global update 2005. Summary of risk assessment. http://www.who.int/phe/air/aqg2006execsum.pdf

Schwela & Zali (eds. 1999) *Urban Traffic Pollution*. Edited by D. Schwela and O. Zali, E & FN Spon, London, New York.

UNEP/WHO (1992) *Urban Air Pollution in Megacities of the World*, Blackwell Publishers, Oxford, UK.

UNEP/WHO (1994) *Global Environmental Monitoring System (GEMS/Air)*, Methodology Review Handbook Series. Volumes 2, 3, and 4.

(b) Internet sites:

http://www.who.int/phe/en/
http://www.euro.who.int/air
http://www.unep.org