

MINISTRY OF ENVIRONMENTAL PROTECTION, PHYSICAL PLANNING AND CONSTRUCTION

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Pursuant to Article 49 of the Air Protection Act (Official Gazette No. 178/04), the Minister of Environmental Protection, Physical Planning and Construction hereby passes the

ORDINANCE ON MONITORING AIR QUALITY

I GENERAL PROVISIONS

Article 1

This Ordinance prescribes the method for monitoring air quality and collecting data, measurement procedures, the method for verifying measurement quality and data, and the method for analysing and presenting results, the method for delivery of data for the purpose of the air quality information system and the method for regular informing the public.

Article 2

For the purposes of this Directive:

- (1) *measurement/sampling frequency* means the number of measurement/sampling results for an individual air quality indicator and/or indirect air quality indicator per unit of time;
- (2) *indicative measurement* means measurement conducted by mobile laboratory or at a provisional sampling location or measurement conducted by diffuse sampling method. In case measurement is conducted occasionally, the set of measurement data must be sufficient for assessment of air pollution level;
- (3) *calibration* means the procedure of determining marking positions on the measuring scale, in relation to corresponding values of measurement dimensions;
- (4) *measurement* means set of procedures determining the value of a certain dimension;
- (5) *measurement period* means the time period between the initial and the final measurement;
- (6) *measurement method* means a meaningful series of procedures, described according to type, which are used to carry out measurement;
- (7) *measuring procedure* means a set of procedures, described according to species, which shall be used to carry out individual measurements in accordance with the particular method;
- (8) *network* means a set of two or more stations for monitoring air quality.
- (9) *agglomeration* means a zone with a population concentration exceeding 250000 inhabitants or, where the population concentration is 250000 inhabitants or less, a population density per km² which is greater than average in the Republic of Croatia, which justifies the need for air quality to be assessed and managed;
- (10) *assessment* means an appropriate method used to measure or estimate (calculate, predict) the level of pollution;
- (11) *air quality data* means the value of each measured, calculated or estimated variable used for determining the quality of air;

- (12) *zone* means a part of territory delimited by the State from other such parts, which presents a functional unit in regards to monitoring, protection and improvement of air quality and air quality management;
- (13) *air quality indicator* means a measurable dimension of a chemical element and/or compound, i.e. physical phase and/or occurrence, which causes change in air quality;
- (14) *indirect air quality indicator* means a measurable dimension used to notice changes on plants, buildings, and in biological findings, which point to the effect of air pollution;
- (15) *station* means a stationary and/or mobile facility equipped to collect, analyse and transfer measured/sampled results, and to observe occurrences important for air quality monitoring;
- (16) *air quality monitoring* means fixed measurements and/or estimates of level of pollution according to a spatial and time schedule;
- (17) *measurement data collection* means manual, semi-automatic and/or automatic registering and safe-keeping of measurement data;
- (18) *measurement quality verification* means verification of stability, accuracy and repeatability of criteria, consistency of the measurement result, measurement accuracy of the gauge, and verification of measurement principles, method or procedure;
- (19) *level of pollution* means the concentration of a pollutant in air or its deposition on surfaces in a given time;
- (20) *fixed measurement site* means a site for carrying out continuous or occasional measurements of levels of pollution;
- (21) *sampling time* means the period of time needed for collecting a single sample;
- (22) *checking* means a set of procedures that is used in certain conditions to establish a relation between the values of the dimensions displayed by the measuring instrument or a measurement system, or the values displayed by a substance measure or a reference substance, and the corresponding values determined as standard;
- (23) *adjustment* means the procedure for bringing the measuring instrument into the technical condition appropriate for its usage;
- (24) *sampling* means the procedure of collecting individual samples of air and precipitation;
- (25) *averaging period* means an interval of time of prescribed duration, over which the average value per time represents the individual value of the pollution level (as requested under the HRN ISO 9169 standard).

II METHOD FOR MONITORING AIR QUALITY AND COLLECTING DATA

Article 3

- (1) For the purposes of monitoring air quality, the following shall be ensured:
- fixed measurement sites at the local and state level;
 - continuous and/or random measurement/sampling of the concentration of pollutants in air at fixed measurement sites;
 - random measurement/sampling of the concentration of pollutants at provisional measurement sites;
 - transfer, processing, validity verification and analysis of measurement data and/or sampling data at measurement sites;
 - verification of quality of measurement procedures and data collected through measurement and/or sampling at measurement sites;
 - maintenance of measurement sites, measurement instruments and equipment for receiving and transferring data.
- (2) Establishment of the network of fixed measurement sites referred to in paragraph 1 subparagraph 1 of this Article requires the following:
- to plan locations for fixed measurement sites on the macroscale;

- to determine locations for fixed measurement sites on the microscale, significant for the assessment of pollution level;
 - to maintain and secure fixed measurement sites;
 - to establish technical conditions for measurement and/or sampling of concentrations of pollutants at fixed measurement sites: set up an appropriate facility for accommodation of measuring instruments, ensure protection against an electric discharge from the atmosphere, ensure availability of electrical power, provide stable power charge, ensure availability of telephone/GSM communications, provide cooling/heating system, set up a device protection system, and provide equipment for collecting, safe-keeping, analysing and transferring data.
- (3) The provisions referred to in paragraph 2 of this Article shall also apply to the establishment of provisional measurement sites referred to in paragraph 1 subparagraph 3 of this Article.

Article 4

- (1) The level of air pollution shall be monitored by measuring the concentration of pollutants in air by using instruments for automatic measurement and/or sampling.
- (2) The sampling procedure shall include preparation, capture, safe-keeping and transport of samples, their laboratory verification and physical-chemical analysis.
- (3) Measurement and/or sampling results shall be assessed according to the prescribed limit, tolerance and target values of levels of pollutants in air.

Article 5

- (1) A fixed measurement site is to be provided with adequate equipment for collecting, safe-keeping, analysis and transfer of data into the air quality information system.
- (2) In order to ensure availability of measurement data for assessment of air pollution in the entire State territory, fixed measurement sites must be provided with spare measuring instruments.
- (3) For the following pollutants: sulphur dioxide (SO₂), oxides of nitrogen expressed as nitrogen dioxide (NO₂), particulate matter, carbon monoxide (CO) and ozone, the number of spare measuring instruments must be at least ten percent of the number of measurement sites i.e. indicators, but may not be less than one measuring instrument.

Article 6

In assessing the level of air pollution, measurement of the concentration of pollutants in air may be substituted by results of modelling air quality or other objective estimation methods for assessing the level of air pollution only if measurement of the level of air pollution is not obligatory under the Air Protection Act.

Article 7

The level of pollution shall be assessed pursuant to the measurement results referred to in paragraphs 1 and 2 of Article 4 of this Ordinance and other available data, such as data obtained by implementation of standardised mathematical models, other estimation methods in accordance with the common practice in the world, and data obtained from the emission cadastre.

Article 8

- (1) Locations of fixed measurement sites for measuring concentrations of air pollutants in agglomerations and industrial zones, shall be determined in accordance with the criteria listed in Annex 1 of this Ordinance.

(2) Locations of fixed measurement sites for measuring background pollution, regional and transboundary long range transmission, and measurements within the framework of international obligations of the State, shall be determined in accordance with the criteria listed in Annex 2 of this Ordinance.

(3) Locations of fixed measurement sites for measuring concentrations of pollutants in air in the zones of cultural and natural heritage shall be determined in accordance with the criteria referred to in Annex 3 of this Ordinance.

(4) Pollutants which are not listed in Annex 1 of this Ordinance, and for which there are no limit values prescribed in the Regulation on limit values of pollutants in air, shall be measured accordingly, at the selected fixed measurement sites listed in Annex 1 of this Ordinance.

Article 9

The minimum number of fixed measurement sites for measuring concentrations of pollutants in air shall be determined pursuant to the criteria referred to in Annex 4 of this Ordinance.

Article 10

(1) Fixed measurement sites in agglomerations where air pollution is subsequent to sulphur dioxide in vicinity of large pollution sources, must be equipped with instruments for measuring hourly and ten-minute average values.

(2) At least two measurement sites significant for assessment of air pollution due to particulate matter PM₁₀, must also provide measurement of concentration of particulate matter PM_{2,5}.

Article 11

(1) Classification and determining locations of fixed measurement sites for measuring concentration of ozone in air shall be carried out by applying the criteria listed in Annex 5 of this Ordinance. At least one fixed measurement site for measuring the concentration of ozone in air must ensure measurement of ozone precursor substances.

(2) Minimum number of fixed measurement sites for measuring the concentration of ozone in air shall be determined by applying the criteria listed in Annex 6 of this Ordinance.

III MEASUREMENT PROCEDURES, METHOD FOR VERIFICATION OF MEASUREMENT QUALITY AND DATA, AND METHOD FOR ANALYSIS AND PRESENTATION OF RESULTS

Article 12

(1) The monitoring of concentrations of pollutants in air and precipitation shall be carried out by applying measurement methods referred to in Annex 7 of this Ordinance.

(2) Apart from the prescribed measurement methods, other measurement methods may be used. Results obtained by other measurement methods must equal the results obtained by applying the measurement methods referred to in Annex 7 of this Ordinance, to be confirmed by submitting a written report on the conducted measurement.

Article 13

For the purpose of pollution level assessment, target quality of data shall be determined with regard to the required accuracy of the measurement method, smallest data volume, uncertainty of the measurement method, and modelling, according to Annex 8 of this Ordinance.

Article 14

The method for verification of measurement quality and data, method for analysis and presentation of results, and assessment of their reliability and credibility, shall be conducted according to the prescribed measurement method and requirements prescribed under the HRN EN ISO/IEC 17025 standard.

Article 15

- (1) Adjustment, calibration and measuring instrument checking shall be conducted according to the prescribed measurement method and requirements prescribed under the HRN EN ISO/IEC 17025 standard.
- (2) Confirmations on measuring instrument checking, issued on the basis of examination conducted in an accredited laboratory, shall be kept for five years.

IV DELIVERY OF INFORMATION FOR THE PURPOSES OF THE AIR QUALITY INFORMATION SYSTEM

Article 16

- (1) Monitoring air quality within the network for air quality monitoring shall be carried out by a legal person, which is professionally and technically qualified to meet the requirements prescribed under the HRN EN ISO/IEC 17025 standard.
- (2) Air quality information system shall be led by the Croatian Environment Agency, and supervised by the Ministry of Environmental Protection, Physical Planning and Construction.
- (3) Owner and/or user of the station for air quality monitoring shall ensure continuous transfer of the measured data related to pollutants, the air concentration of which shall be determined by using measuring instruments for automatic computer network measurement, into the air quality information system.

Article 17

- (1) A report on monitoring air quality must be made each year for every fixed measurement site.
- (2) The report on monitoring air quality must comprise data on:
 - the institution conducting air quality monitoring,
 - measurement sites used for sampling and the range of measurement,
 - duration and method of sampling,
 - measurement methods and measuring equipment used ,
 - ensuring the quality of data as prescribed under the HRN EN ISO/IEC 17025 standard,
 - other data related to ensuring quality, such as providing continuity, taking part in parallel measurements, deviations from prescribed methodology and reasons therefor,
 - assessment of air pollution.
- (3) Assessment of air pollution referred to in paragraph 2 subparagraph 7 of this Article shall comprise information on:
 - pollution level, when exceeding the tolerance value, zones and agglomerations where these levels were measured, dates and periods;
 - pollution level, when exceeding the limit value, zones and agglomerations where these levels were measured, dates and periods;
 - causes for exceedance of tolerance and/or limit value;
 - exceedances of alert thresholds, zones and agglomerations where the exceedances were measured, dates and periods;
 - zones and agglomerations where levels of pollutants are lower than the limit values;
 - arithmetic mean, median, 98th percentile and maximum value;

- calculated statistical parameters of air pollution due to ozone, according to the criteria laid down in Table 4 of the Regulation on ozone in air;
- average annual value of ozone precursor substances;
- methods applied during assessment of air pollution.

(4) For zones or agglomerations where, in assessing air pollution, measurements are supplemented by other sources of information, or other sources of information alone are used for the assessment of air quality, the report must comprise the following information:

- description of conducted assessment,
- mathematical models and/or other assessment methods used, in accordance with common practice in the world, including the aforementioned method descriptions,
- sources of data and information, and
- evaluation of results.

(5) The report on monitoring air quality shall also comprise a short evaluation of exceedances of the limit values, and adequate information related to effects on human health and vegetation.

(6) The report on monitoring air quality shall comprise graphic annexes at a scale of 1: 25000 with marked zones and agglomerations where the limit and/or tolerance values are exceeded, also marking the areas of alert threshold and information threshold exceedances.

Article 18

(1) The Annual report on monitoring air quality on the territory of the Republic of Croatia shall be submitted to the Ministry of Environmental Protection, Physical Planning and Construction by the Agency for Environmental Protection no later than 31 July of the current year for the previous calendar year.

(2) The Report referred to in paragraph 1 of this Article shall be published on the web sites of the Ministry of Environmental Protection, Physical Planning and Construction and the Croatian Environment Agency.

Article 19

The Report on monitoring air quality referred to in Article 17, paragraph 1 and Article 18, paragraph 1 of this Ordinance shall be kept for ten years.

V INFORMING THE PUBLIC

Article 20

(1) The Ministry of Environmental Protection, Physical Planning and Construction, local and regional self-government units and the Croatian Environment Agency shall ensure that all obtainable data on concentrations of pollutants in air, are available to the public, to organisations for environmental protection and consumers protection, to institutions advocating the interests of vulnerable categories of population and to health care organisations.

(2) Obtainable data referred to in paragraph 1 of this Article relate to the following:

- concentrations of sulphur dioxide, nitrogen dioxide and particulate matter in air that shall be published daily, while data referring to hourly values for sulphur dioxide and nitrogen dioxide shall be published each hour;
- concentrations of benzene in air, as average value for the previous 12-month period, which shall be published at least once every three months, and if possible, each month;
- concentrations of carbon monoxide in air, as the maximum 8-hour average, which shall be published daily, and if possible, each hour;

- concentrations of hydrogen sulphide in air, which shall be published daily, and if possible, each hour;
- concentrations of ammonia in air, which shall be published daily;
- concentrations of ozone in air, which shall be published daily, and if possible, each hour;
- concentrations of lead and other heavy metals in particulate matter, which shall be published once in every three months, and if possible, each month;
- concentrations of particulate matter PM10 and PM2,5 in air, which shall be published once in every three months, and if possible, each month.

(3) Obtainable data referred to in paragraph 1 of this Article, along with other data on air quality, shall be published on the web sites of the Ministry of Environmental Protection, Physical Planning and Construction and the Croatian Environment Agency, and by other appropriate means.

Article 21

In an agglomeration where the alert thresholds for sulphur dioxide, nitrogen dioxide and/or ozone are exceeded, the public shall be informed in compliance with the Regulation on alert thresholds of pollutants in air.

VI TRANSITIONAL AND FINAL PROVISIONS

Article 22

Annexes 1, 2, 3, 4, 5, 6, 7 and 8 with the corresponding content shall be published along with this Ordinance and shall form a constituent part thereof.

Article 23

The provisions of Article 16, paragraphs 1 and 3 of this Ordinance shall apply as of 1 January 2007.

Article 24

The Report on air quality monitoring referred to in Article 17 paragraph 1 and Article 18 paragraph 1 of this Ordinance shall be drawn up in 2006 according to all available data from the year 2005.

Article 25

This Ordinance shall enter into force on the eighth day from its publication in the Official Gazette.

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No.: 531-01-05-1

Zagreb, 23 December 2005

Minister

Marina Matulović Dropulić, m.p.

ANNEX 1

LOCATIONS OF FIXED MEASUREMENT SITES FOR MEASURING SULPHUR DIOXIDE, NITROGEN DIOXIDE AND OXIDES OF NITROGEN, PARTICULATE MATTER (PM₁₀ AND PM_{2,5}), HEAVY METALS IN PM₁₀ AND PM_{2,5}, CARBON MONOXIDE AND BENZENE IN AIR IN AGGLOMERATIONS AND INDUSTRIAL AREAS

During the establishment of fixed measurement sites, in selecting locations for fixed measurement sites, the following criteria shall apply:

A. MACROSCALE SITING

(a) Protection of human health

1. Measurement sites directed at the protection of human health should be sited:
 - to provide data on the areas within zones and agglomerations where the highest concentrations occur, to which the population is likely to be exposed for a period which is significant in relation to the averaging period of the limit or tolerance values;
 - to provide data on levels of concentrations in other areas within the zones and agglomerations which are significant in relation to the general exposure of the population;
 - to provide data on bulk deposition which is representative of the indirect exposure of the population through the food chain.
2. Measurement sites should in general be selected to avoid measuring micro-environments. As a guideline, a measurement site must be selected to be representative of air quality in a surrounding area of no less than 200 m² at traffic-oriented sites, at least 250 m x 250 m in industrial areas and of several square kilometres at urban-background sites.
3. Measurement sites for monitoring urban-background pollution levels should be selected so that their pollution level is influenced by the integrated (combined) contribution from all sources upwind of the site. A measuring site should not be dominated by a single source, unless such a situation is typical for a larger urban area. As a rule, those measurement sites should typically be representative for several square kilometres.
4. Where the objective is to measure/assess background pollution levels, the measurement site should not be influenced by an agglomeration or industry in its vicinity, that is, the site should be at a distance of at least a few kilometres from these areas.
5. Where contributions from industrial sources is to be assessed, at least one measurement site should be installed downwind of the source in the nearest residential area. Where the background concentration values are not known, an additional measuring site should be situated in the main wind direction.
6. Measurement sites should, where possible, be located so as to be representative of similar locations not in their immediate vicinity.
7. When selecting locations, account should be taken of the need to locate measurement sites on islands, where necessary for the protection of human health.

(b) Protection of vegetation

Measurement sites directed at the protection of vegetation must be sited more than 20 km away from agglomerations or more than 5 km away from other build-up areas, industrial installations or motorways. This means that the measuring site must be positioned in such a way that the air sampled is representative of air quality in a surrounding area of at least 1000 km². Depending on the geographical conditions or taking into account measurements conducted on islands, measuring sites may be representative of the area of less than 1000 km².

B. MICROSCALE SITING

In relation to microscale siting, the following shall apply to the fullest extent possible:

- the flow around the inlet sampling probe shall be unrestricted so as to allow free airflow (in an arc of at least 270°) and without any obstructions affecting the airflow (usually a few metres away from buildings, balconies, trees and other obstacles; in case the obstacle protrudes above the sampler, it must be placed at a distance of more than twice the height of the obstacle; and at least 0,5 m from the nearest building in the case of sampling points representing air quality at the building/obstacle line);
- in general, the inlet sampling probe shall be between 1,5 m (the breathing zone) and 4 m above the ground. Higher positions (up to 8 m) may be necessary in some circumstances. Higher siting may also be appropriate if the station is representative of a large area;
- the sampler shall not be positioned in the immediate vicinity of emission sources in order to avoid direct intake of emissions unmixed with air;
- the sampler shall be positioned so that recirculation of exhaust air to the sample inlet is avoided;
- location of traffic-oriented samplers:
 - (a) for all pollutants, such sampling points shall be at least 25 m from the edge of major junctions and at least 4 m from the centre of the nearest traffic lane;
 - (b) for nitrogen dioxide and carbon monoxide, inlets shall be no more than 5 m from the kerbside;
 - (c) for particulate matter, lead and benzene, inlets shall be sited so as to be representative of air quality near to the building line, but no more than 10 m from the kerbside.

The following factors should also be taken into account:

- interfering sources;
- security;
- access;
- availability of electrical power and telephone communications;
- visibility of the measurement site in relation to its surroundings;
- safety of public and technical staff (operators);
- the desirability of co-locating sampling points and measuring instruments for measuring concentrations of different pollutants;
- regulations on spatial planning.

C. DOCUMENTATION AND REVIEW OF SITE SELECTION

The site-selection procedure shall be fully documented at the classification stage. The physical location of the measurement site should be selected and photographed, also providing detailed photographs of the surrounding area and a detailed map. A measurement site should be reviewed at regular intervals to ensure that selection criteria remain valid over time.

ANNEX 2

LOCATIONS OF FIXED MEASUREMENT SITES FOR MEASURING BACKGROUND POLLUTION, REGIONAL AND TRANSBOUNDARY LONG RANGE TRANSMISSION, AND MEASUREMENTS WITHIN THE INTERNATIONAL OBLIGATIONS OF THE STATE

A. OBJECTIVES

The main objective of such measurements is to ensure that adequate information is made available on background concentration levels of pollutants. This information is essential for the following:

- to assess the increase in concentration levels in more polluted areas (such as urban-background, industry related locations, traffic related locations);
- to assess the possible contribution from long range transmission of air pollutants by using the existing levels of emissions released from respective sources (in urban-background, industry related locations and traffic related locations);
- to support apportionment analysis, i.e. to assess the origin of pollution measured at background locations; and
- to assess the critical environmental burdening related to problems of acidification and eutrophication, photochemical oxidants, transmission and deposition of heavy metals, non-volatile organic compounds and particulate matter.

These measurements are essential for the understanding of origin and concentration levels of the specific pollutants, such as particulate matter, ground-level ozone and its precursor substances, heavy metals and non-volatile organic compounds.

Further, this background information is essential for the use of atmospheric modelling on the regional and continental scale, and also in urban areas.

B. POLLUTANTS INCLUDED IN MEASUREMENTS

The measurement programme on background stations should include parameters significant for long range, regional and transboundary transmission and deposition of pollution (critical environmental burdening), which shall ensure the observance and analysis of specific processes:

a) Acidification and eutrophication:

- concentrations of inorganic components in precipitation and air:

precipitation: SO_4^{--} , NO_3^- , NH_4^+ , H^+ (pH), Na^+ , K^+ , Ca^{++} , Mg^{++} , Cl^- , conductivity

air: SO_2 , NO_2 , NH_3 , HNO_3 , SO_4^{--} , NO_3^- , NH_4 , Na^+ , K^+ , Ca^{++} , Mg^{++}

- proportion of gaseous and particulate components in air: NH_3 , HNO_3 , NH_3/NH_4 , HNO_3/NO_3

b) Photochemical oxidants:

- concentrations of ozone and photochemical oxidants: ozone (O_3), NOX (NO , NO_2), $\text{C}_2\text{-C}_7$, aldehydes and ketones

c) Transmission and deposition of heavy metals:

- concentrations of heavy metals in precipitation and air: Cd, Pb (primary), Cu, Zn, As, Cr, Ni (secondary)

- concentration of mercury in precipitation (Hg) and air (Hg[TGM])

d) Transmission and deposition of non-volatile organic compounds:

- concentration of non-volatile organic compounds in precipitation and air: PAU, PCB, HCB, chlordane, HCH, DDT/DDE

e) Transmission and composition of particulate matter in air:

- mass and concentration of inorganic compounds in particulate matter PM_{10} and $\text{PM}_{2.5}$: SO_4^- , NO_3^- , NH_4^+ , Na^+ , K^+ , Ca^{++} , Mg^{++} , Cl^- ;

- mineral dust concentration: Si

- concentration of elemental (EC) and organic (OC) carbon,

f) Meteorology: precipitation quantity, direction and speed of the wind, air temperature, relative air humidity, air pressure.

For the purposes of understanding and analysing chemical processes in the atmosphere and environment, it is necessary to ensure simultaneous measurements of all parameters at at least one measurement location, depending on its position and ability to represent a larger area.

All locations envisaged for background measurements may, or may not have the entire measurement programme described in items a) – e). The measurement programme should be adjusted to each individual location with regard to its specific purpose, geographical position, zone, and distance from agglomerations. Stations may be specialised in order to ensure observance of individual, but interrelated processes, such as those described in items [a), b), e) and f)] or [a), e) and f)] or [a), c) and f)] or [a), d) and f)] or [a), b) and f)].

The programme, period and frequency of background location measurements shall be coordinated with the criteria listed in the Programme for monitoring and evaluation of long range transmission of air pollutants in Europe (EMEP).

C. MEASUREMENT LOCATIONS

Basic criteria for the location of background pollution measurement shall be installation in natural rural surroundings. The following conditions should be taken into account:

1. SIGNIFICANCE OF THE LOCATION WITHIN THE LARGER AREA

The selected location shall be representative of a larger area. The size of this area shall depend on characteristics and variability of the quality of air and precipitation. Locations in vicinity of urban and industrial areas are not desirable due to their significant impact on background concentrations, because of which background measurements may become pointless. The size of the representative location area shall vary from at least 25 km x 25 km to 50 km x 50 km (i.e., from approximately 500 to 2500 km²). Representativeness of the area shall depend on geographical and climatic conditions, air movements at the altitude of pollutant transmission, meteorological conditions of the location, and vicinity, i.e. distance from big emission sources.

With regard to distance from the emission sources, the general criteria listed in the Table, shall serve as guidelines:

Minimum distance from the source of emission and contamination

Type of source	Minimum distance	Note
Large emission sources (cities, thermo-electric power facilities, motorways)	50 km	Depending on the prevailing direction of wind
Small home ovens using coal, oil or wood	100 m	Only one emission source per this distance
Local roads	100 m	Up to 50 vehicles per day
Main roads	500 m	Up to 500 vehicles per day
Stable manure, live-stock farms	2 km	Depending on the size of the live-stock farm and the size of manured area or grassland
Live-stock grazing at cultivated, manured grazing lands	500 m	Depending on the size of the live-stock farm and the size of manured area or grassland

Location significance is achieved more easily for secondary pollutants (such as sulphate aerosols and ozone) than for the primary ones. Measuring ammonia concentrations in rural

areas presents a specific problem due to emissions caused by agricultural and cattle-raising activities. Therefore, the measurement site should be positioned at a proper distance from the areas dominated by such activities. Local emission sources are generally of small significance for monitoring concentrations of sulphur and nitrogen compounds in precipitation, nevertheless, the vicinity of dust and ammonia sources should be avoided. Even in the case of applying wet-only precipitation collector, dust from its surroundings may cause a serious contamination problem.

Distances given in the above Table, shall be considered as orientational. Analysis and assessment of impact of the local pollution sources shall be made pursuant to the review of meteorological and topographic conditions, and taking into account the size and distances of individual emission sources.

2. LOCATION SIGNIFICANCE WITH REGARD TO TOPOGRAPHIC AND CLIMATIC CONDITIONS

A location should be representative with regard to the characteristics of air masses. Plains and other locations typical of stagnant air masses and temperature inversions should be avoided. Mountain tops and passes should also be avoided. Ideally, a measurement site shall be positioned in a mildly hilly area, and in case that the plain cannot be avoided, on a hillside above the limit of the night temperature inversion. Locations in coastal areas with considerable day-night differences due to land-sea circulation are also not recommended.

Taking into account that vegetation represents an inlet for the majority of pollutants in the atmosphere, a measurement site should not be sheltered by trees, since that may cause significant decrease of the concentration levels. Furthermore, a measurement site should not be exposed to strong winds or sheltered by high buildings.

The annual precipitation quantity at the measurement location should not significantly differ from the quantity measured at the neighbouring meteorological stations within the national network, while the daily precipitation quantities should also be comparable to those measured at the neighbouring meteorological stations.

Position of the precipitation sampler should meet the criteria of the World Meteorological Organisation: there should be no obstacles such as trees and facilities on the line of horizon above 30° measured from the edge of the sampler. Buildings, fringes and other topographic formations, which may cause upward and downward air currents, should also be avoided. The position of the sampler should be adjusted according to the currents prevailing during precipitation occurrences, in order to ensure maximum efficiency in collecting precipitation.

Especially significant is the possible contamination due to deposition of earth dust particles from the immediate surroundings. The vicinity of stony paths, country roads and agricultural grounds, within 100 m to 1 km, should be avoided. The surface of the measurement site should be covered by grass.

3. TECHNICAL CONDITIONS OF THE MEASUREMENT SITE

Measuring devices and instruments for air quality sampling shall be positioned in a smaller facility ensuring availability of electrical power. Temperature in the room where pumps and control measuring devices are stored shall be maintained at about 20°C. For the purpose of short term preservation of samples in the facility, it shall be necessary to provide a refrigerator. In the case that automatic continuous ozone measurements are carried out at the location, it shall be necessary to ensure telephone communications for the purposes of data transmission and control of the measuring device. Access by car or terrain vehicle shall be allowed only to persons in charge of supervision and implementation of the measurement programme.

4. DOCUMENTATION

Documentation of the measurement site shall include data on the purpose and usage of the ground, area topography and meteorological conditions (circulation, climatic data), in the form of maps, tables and diagrams. It is necessary to provide and regularly update the emission cadastre for the area of about 20 km from the measurement site. In order to determine the representativeness of the location, the availability of data on air quality within the same area, shall be desirable. These may be provided through mathematical modelling for the area, or by applying limited duration measurements.

5. DISTANCE BETWEEN BACKGROUND MEASUREMENT LOCATIONS

The maximum distance between neighbouring background measurement locations shall depend on several factors such as:

- spatial gradients within the concentrations field, as the consequences of prevailing macroscale air currents,
- chemical transformations in atmosphere and deposition caused by precipitation.

Further, the aforementioned distance shall also depend on the power of emission sources, air currents, topography and chemical and physical characteristics of individual pollutants. Following the analysis of available information regarding Europe, it has been estimated that the distance between measurement locations should range from 150-200 km in central Europe, to no more than 300 km in areas where the main emission sources are at least 500 km away.

ANNEX 3

LOCATIONS OF FIXED MEASUREMENT SITES FOR MEASURING AIR QUALITY IN AREAS OF CULTURAL AND NATURAL HERITAGE

A. OBJECTIVES

The main objective of such measurements is to ensure that adequate information is made available on pollutant concentrations which may have an adverse effect to vulnerable environmental systems, autochthonous flora and fauna and biodiversity, and may cause general decrease of quality of air, waters and soil in these areas due to regional and long range transmission of pollutants. Such measurements shall provide information essential for:

- levels and trends of pollutant concentrations in these areas;
- assessment of the contribution from long range transmission of air pollutants by using the existing levels of emissions released from respective sources;
- analysis and assessment of the origin of air pollution, and episodic conditions causing enhanced concentration levels and stressful circumstances in environmental systems;
- to assess the critical environmental burdening related to the problems of acidification and eutrophication, photochemical oxidants, transmission and deposition of heavy metals, non-volatile organic compounds and particulate matter.

These measurements are essential for the understanding of interrelations of atmospheric pollution levels and vulnerable elements of the environmental system, including planning and imposing measures for their preservation.

B. POLLUTANTS INCLUDED IN MEASUREMENTS

Programme of measurements conducted in areas of cultural and natural heritage should include parameters significant for long range, regional and transboundary transmission and deposition of pollutants (critical environmental burdening), which shall ensure the observance

and analysis of specific processes causing adverse consequences and disruption of biological balance in the environment. These are the processes of acidification and eutrophication, photochemical oxidants, transmission and deposition of heavy metals, non-volatile organic compounds and particulate matter. For this reason, the general content of the programme shall be compliant with the programme established on stations for monitoring background pollution.

Taking into account that according to their type, these locations belong to a category of natural rural areas, which are distant from larger pollution sources and traffic lanes, they generally meet the basic criteria for background measurement stations. The measurement programme of each individual location should take into account the specific qualities and vulnerability of a certain environmental system, along with the expected exposure to specific pollutants which may threaten the system.

Considering that the areas of national parks, nature parks, protected areas, vulnerable environmental systems, and areas of cultural and natural heritage are geographically determined, the measurement programme shall pay special attention to the spatial distance from the dominant emission parameters, which largely contribute to the burdening of each individual location.

For the purposes of analysing and determining the interaction between atmospheric pollution and natural ecosystems at such locations, conducting partial or integral monitoring of the quality of waters, soil, vegetation and forests, shall be highly desirable.

C. MEASUREMENT SITE LOCATIONS

The main criteria for locating measurement sites in the areas of cultural and natural heritage shall be their positioning in natural rural surrounding, taking into account the general guidelines given in Annex 1, item A(b) and the instructions given in Annex 2.

ANNEX 4

CRITERIA FOR DETERMINING THE MINIMUM NUMBER OF FIXED MEASUREMENT SITES FOR MEASURING CONCENTRATIONS OF AIR POLLUTANTS: SO₂, NO₂, PM₁₀, PM_{2,5}, CO, benzene, heavy metals in PM₁₀ and PM_{2,5} (As, Cd, Ni) and benzo(a)pyrene

A. Minimum number of sites for fixed measurement to assess compliance with limit and tolerance values of air pollution for the protection of human health and alert thresholds in zones and agglomerations where fixed measurement is the sole source of information

(a1) Diffuse sources: SO₂, NO₂, PM₁₀, PM_{2,5}, CO, benzene

Population of zone (thousands)	If concentrations exceed the upper assessment threshold ⁽¹⁾	If maximum concentrations are between the upper and lower assessment thresholds
0-249	1	1
250-499	2	1

500-749	2	1
750-999	3	1
1000-1499	4	2
1500-1999	5	2
2000-2749	6	3
2750-3749	7	3
3750-4749	8	4
4750-5999	9	4
≥ 6000	10	5

⁽¹⁾ For NO₂, particulate matter, carbon monoxide and benzene: include at least one urban background monitoring station and one traffic-oriented station provided this does not increase the number of measurement points. The total number of urban background stations and the total number of traffic-oriented stations shall not differ by more than a factor of 2.

(a2) Diffuse sources: heavy metals in PM₁₀ and PM_{2.5} – As, Cd, Ni, benzo(a)pyrene

Population of zone (thousands)	If concentrations exceed the upper assessment threshold ⁽¹⁾		If maximum concentrations are between upper and lower assessment thresholds	
	As, Cd, Ni	B(a)P	As, Cd, Ni	B(a)P
0-749	1	1	1	1
750-1999	2	2	1	1
2000-3749	2	3	1	1
3750-4749	3	4	2	2
4750-5999	4	5	2	2
≥ 6000	5	5	2	2

(b) Point sources

For the assessment of pollution in the vicinity of point sources, the number of fixed measurement sites shall be calculated taking into account emission densities, the likely distribution patterns of air pollution and the potential exposure of the population.

Measurement sites must be positioned as to allow monitoring of the implementation of the best technology available.

B. Minimum number of sites for fixed measurement to assess compliance with the PM_{2,5} exposure reduction target for the protection of human health

For this purpose, one measurement site per one million inhabitants should be ensured, applied to agglomerations while additional stations should be ensured per each 100 000 inhabitants. Measurement locations may coincide with those under item A of this Annex.

C. Minimum number of points for measurement to assess compliance with alert thresholds for the protection of vegetation in zones other than agglomerations

If maximum concentrations exceed the upper assessment threshold	If maximum concentrations are between upper and lower assessment thresholds
1 measurement station every 20 000 km ²	1 measurement station every 40 000 km ²

In island zones, the number of stations for fixed measurement should be calculated taking into account the likely distribution patterns of air pollution and the potential exposure of vegetation.

⁽¹⁾ Include at least one urban background station, and for benzo(a)pyrene at least one traffic-oriented station, unless it increases the total number of sampling points.

ANNEX 5

CRITERIA FOR CLASSIFYING AND LOCATING FIXED MEASUREMENT SITES FOR MEASURING OZONE CONCENTRATIONS

For classifying and locating fixed measurement sites for measuring ozone concentrations in air, the following criteria shall apply:

A. MACROSCALE SITING

Type of station	Objectives of measurement	Representativeness ^(a)	Macroscale siting criteria
URBAN	Protection of human health: to assess the exposure of the urban population to ozone, i.e. where population density and ozone concentrations are relatively high and representative of the exposure of the general population	Several km ²	Away from the influence of local emission sources such as traffic, petrol stations, etc.; Vented locations where well mixed levels can be measured; Locations such as residential and commercial areas of cities, parks (away from trees), big streets or squares with very little or no traffic, open areas characteristic of educational, sports or recreation activities.
SUBURBAN	Protection of human health and	Some tens of km ²	At a certain distance from the area of maximum emissions,

	vegetation: to assess the exposure of the population and vegetation located on the outskirts of agglomeration, where the highest ozone levels, to which the population and vegetation is likely to be directly or indirectly exposed, occur		downwind following the main wind direction during conditions favourable to ozone formation; Where population, sensitive crops or natural ecosystems located in the outer fringe of an agglomeration are exposed to high ozone levels; Where appropriate, at suburban locations in the direction opposite to the general direction of currents and maximum emissions, in order to determine the regional background levels of ozone.
RURAL	Protection of human health and vegetation: to assess the exposure of population, crops and natural ecosystems due to sub-regional scale ozone concentrations	Sub-regional levels (several km ²)	Stations can be located in small settlements and/or areas with natural ecosystems, forests or crops; Representative for ozone away from the influence of immediate local emissions such as industrial installations and roads; At open area locations, but not on higher mountain tops.
RURAL BACKGROUND	Protection of vegetation and human health: to assess the exposure of crops and natural ecosystems to regional-scale ozone concentrations as well as exposure of the population	Regional/national/continental levels (1 000 to 10 000 km ²)	Stations located in areas with lower population density, e.g. with natural ecosystems, forests, far removed from urban and industrial areas and away from local emissions; Avoid locations which are subject to locally enhanced formation of ground-near inversion conditions, also summits if higher mountains; Coastal sites with pronounced diurnal wind cycles of local character are not recommended.

(a) Measurement sites should, where possible, be representative of similar locations not in their immediate vicinity.

For rural and rural background stations, the measurement location site shall, where appropriate, be coordinated with the monitoring requirements concerning protection of forests against atmospheric pollution (Commission Regulation 1091/94 of 18 May 1994).

B. MICROSCALE SITING

In so far as practicable the criteria related to microscale siting described in Chapter B of Annex III shall be applied, also ensuring that the sampler shall be positioned well away from such sources as furnaces and incineration flues and more than 10 m from the nearest road, with distance increasing as a function of traffic intensity.

C. DOCUMENTATION AND REVIEW OF THE MEASUREMENT SITE

Procedures described in Chapter C of Annex III shall be followed here as well, applying proper selection and interpretation of the monitoring data in the context of meteorological and photochemical processes affecting the ozone concentrations measured at the respective site.

ANNEX 6

CRITERIA FOR DETERMINING THE MINIMUM NUMBER OF MEASUREMENT LOCATIONS FOR MEASUREMENT OF OZONE CONCENTRATIONS

A. Minimum number of fixed measurement sites for continuous measurements to assess air quality in view of compliance with target values, long term objectives and information and alert thresholds where such measurements are the sole source of information

Population (u 1000)	Agglomerations (urban and suburban) ^(a)	Other zones (suburban and rural) ^(a)	Rural background
< 250		1	1 station per 50 000 km ² as an average density per zones on the entire state territory ^(b)
< 500	1	2	
< 1 000	2	2	
< 1 500	3	3	
< 2 000	3	4	
< 2 750	4	5	
< 3 750	5	6	
> 3 750	1 additional station per 2 million inhabitants	1 additional station per 2 million inhabitants	

(a) At least one station in suburban areas, where the highest exposure of the population to ozone concentrations is likely to occur. In agglomerations at least 50% of the stations shall be located in suburban areas.

(b) 1 station per 25 000 km² for complex terrain is recommended.

B. Minimum number of sites for fixed measurement for zones and agglomerations where long term objectives have been attained

The number of measurement sites for ozone shall, in combination with other means of supplementary assessment such as: atmospheric modelling and co-located nitrogen dioxide measurements, be sufficient to examine the trend of ozone pollution and check compliance with the long term objectives. The number of measurement stations located in agglomerations and other areas may be reduced to one-third of the number specified in Chapter A of this Annex. Where information from fixed measurement stations is the sole source of information, at least one monitoring station shall be kept. If in zones where there is supplementary assessment, there are no remaining measurement stations, coordination with a number of stations in neighbouring zones shall ensure adequate assessment of ozone concentrations against long term objectives. The number of rural background stations shall be 1 per 100 000 km².

ANNEX 7

MEASUREMENT METHODS

A1. MEASUREMENT METHODS FOR CONTINUOUS MONITORING OF AIR QUALITY

Pollutant	Measurement method	Measurement/analysis method principle
SO ₂	Continuous measurement by analyser HRN EN 14212:2005	UV fluorescence
NO/NO ₂	Continuous measurement by analyser HRN EN 14211:2005	Chemiluminescence
PM ₁₀	Continuous measurement by analyser, sampler of a large and medium air absorption volume HRN EN 12341:1999	TEOM, beta radiation absorption, gravimetric
PM _{2,5}	Continuous measurement by analyser, sampler of a large and medium air intake volume HRN EN 14907:2005	TEOM, beta radiation absorption, gravimetric
O ₃	Continuous measurement by analyser HRN EN 14625:2005	UV absorption
CO	Continuous measurement by analyser HRN EN 14626:2005	IR spectroscopy
H ₂ S	Continuous measurement by analyser (equivalent to the method HRN EN 14212:2005)	UV fluorescence
benzene	Continuous measurement by analyser HRN EN 14662:2005	BTEX

A2. MEASUREMENT METHODS TO ASSESS CONCENTRATION AND DEPOSITION OF LEAD, ARSENIC, CADMIUM, NICKEL, POLYCYCLIC AROMATIC HYDROCARBONS AND MERCURY IN AIR

Pollutant	Measurement method	Measurement/anal
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		ysis method principle
Pb, As, Cd, Ni	Manual sampling PM ₁₀ , HRN EN 14902:2005	Sample analysis by method AAS or ICP mass spectrometry
Polycyclic aromatic hydrocarbons	Method for benzo(a)pyrene is subjected to standardisation procedure ⁽¹⁾ : manual sampling PM ₁₀ (equivalent to standard HRN EN 12341)	Gaseous chromatography – mass spectrometry (GC-MS)
Total gaseous mercury (Hg)	In standardisation procedure ⁽¹⁾ : golden partition method	AAS or atomic fluorescence spectrometry (CV-AFS)

(1) Due to lack of standardised SEC method, national or ISO reference methods (e.g. ISO standard 12884 for benzo(a)pyrene and other polycyclic aromatic hydrocarbons) may be used instead. Other methods may also be used if proved equivalent to the methods mentioned above.

A3. REFERENCE METHODS FOR AIR QUALITY MODELLING

Reference techniques for air quality modelling cannot be specified at this moment.

B. SAMPLING METHODS FOR ASSESSMENT OF POLLUTANT CONCENTRATIONS AT BACKGROUND STATIONS AND STATIONS IN ZONES OF CULTURAL AND NATURAL HERITAGE

	Pollutant	Measurement density	Measurement period	Measurement method	Laboratory method
GASES	SO ₂	24 hours	daily	KOH-impregnated filter paper	IC ¹
	NO ₂	24 hours	daily	NaI-impregnated glass filter	IC
	HNO ₃	24 hours	daily	denuder	IC
	NH ₃	24 hours	daily	denuder	IC
	Light hydrocarbons (C ₂ -C ₅)	10 – 15 min	Two times per week	steal canister	GC ²
	Ketones and aldehydes (VOC)	8 hours	Two times per week	solid adsorbent layered with 2,4-dinitrophenylhydrazine	HPLC with UV detection ³

				zine (DNPH cassette)	
	Hg (TGM)	24 hours	Weekly	golden partition	CV-AFS ⁴
PARTICULATE MATTER	SO ₄ ²⁻	24 hours	daily	aerosol filter	IC
	NO ₃ ⁻	24 hours	daily	aerosol filter behind denuder	IC
	NH ₄ ⁺	24 hours	daily	aerosol filter behind denuder	IC/Indophe nol
	Na ⁺ , Mg ₂ ⁺ , Ca ₂ ⁺ , K ⁺ , Cl ⁻	24 hours	daily	aerosol filter	IC/AAS5/A ES6
	PM ₁₀	24 hours	daily	HRN EN 12341 (gravimetric), TEOM	Micro scale, Analyser
	PM _x	24 hours	daily	HRN EN 12341, TEOM	Micro scale, Analyser
PARTICLES	Mineral dust, Si	24 hours	daily	HRN EN 12341	INAA7, PIXE8, XRF9
	EC and OC	24 hours	daily	HRN EN 12341	Thermo-desorption and oxidation
	OC differentiation	24 hours	Once per week	HRN EN 12341	LC-MS ¹⁰
	Cd, Pb	Weekly	Weekly	HRN EN 12341	ICP-MS/GF-AAS ¹¹
	Cu, Zn, As, Cr, Ni	Weekly	Weekly	HRN EN 12341	ICP-MS/GF-AAS
GASES + PARTICLES	HNO ₃ (p) + NO ₃ ⁻ (c)	24 hours	Weekly	Three-level filter system	IC
	NH ₃ (p) + NH ₄ ⁺ (c)	24 hours	Daily	Three-level filter system	IC
	POPs (PAH, PCB, HCB, chlordan, lindane, a-HCH, DDT/DDE)	Weekly	Weekly	Sampler with polyurethane foam	GC-MS ¹²

Abbreviation meaning:

1. IC Ion Chromatography

2.	GC	Gas Chromatography
3.	HPLC	High Performance Liquid Chromatography with UV Detector
4.	CV-AFS	Vapour Atomic Fluorescence Spectrophotometry
5.	AAS	Atomic Adsorption Spectrometry
6.	AES	Atomic Emission Spectrometry
7.	INAA	Neutron Activation Analysis
8.	PIXE	Proton-Induced X-ray Emission
9.	XRF	X-ray Fluorescence
10.	LC-MS	Liquid Chromatography – Mass Spectrometry
11.	ICP-MS/GF-AAS	Inductively Coupled Plasma – Mass Spectrometry/Graphite Furnace – Atomic Adsorption Spectrometry
12.	GC-MS	Gas Chromatography – Mass Spectrometry

C. MEASUREMENT METHOD FOR DETERMINING CHEMICAL COMPOSITION OF PRECIPITATION

Pollution component	Measure ment period	Measurem ent density	Measurement method	Method of analysis
Precipitation quantity	24 hours	daily	Standard rain-gauge	Scale length
Ph	24 hours	daily	»wet«– automatic precipitation sampler and/or	pH metre, glass electrode
Conductivity	24 hours	daily		conductometre WTW
SO ₄ ²⁻ , NO ₃ ⁻ , Cl ⁻ , NH ₄ ⁺ , Na ⁺ , K ⁺ , Ca ²⁺ , Mg ²⁺ , F ⁻ , PO ₄ ³⁻	24 hours	daily		Ion chromatograph y
Cd, Pb	Weekly	Weekly	»bulk«– polyurethane precipitation sampler	Flame or graphite furnace atomic adsorption spectrometry
Zn ²⁺ , Mn ²⁺ , Fe ²⁺ , Al ³⁺	Weekly	Weekly		
Hg ²⁺	Weekly	Weekly	»wet« automatic precipitation sampler	Vapour atomic fluorescence spectrophotome try (CV-AFS)
POPs (PAH, PCB, HCB, chlordan, lindane, a-HCH, DDT/DDE)	Weekly	Weekly	»wet« automatic precipitation sampler	Gas chromatograph y (GC)-mass spectrometry (MS)

D. STANDARDISATION

For gaseous pollutants the air volume must be standardised at a temperature of 293 K and atmospheric pressure of 101,3 kPa. For particles and pollutants contained in particles (e.g. lead) the sampling volume shall refer to ambient conditions.

ANNEX 8

DATA QUALITY OBJECTIVES

A. DATA QUALITY OBJECTIVES FOR AIR QUALITY ASSESSMENT

Data quality objectives listed in Table 1 and 2 are given in order to consider the uncertainty of the assessment methods, minimum time coverage and minimum data capture, required to ensure a high quality programme.

Table 1:

	Sulphur dioxide, nitrogen dioxide and oxides of nitrogen	Benzene	Carbon monoxide	Particulate matter (PM ₁₀ /PM _{2,5}) and lead	Ozone and related oxides of nitrogen: NO and NO ₂
Fixed measurements: ⁽¹⁾					
Uncertainty	15%	25%	15%	25%	15%
Minimum data capture	90%	90%	90%	90%	90% in summer
Minimum time coverage:	–	35% ⁽²⁾	–	–	75% in winter
(urban, background and traffic)	–	90%	–	–	–
Indicative measurement: ^(1a)					
Uncertainty	25%	30%	25%	50%	30%
Minimum data capture	90%	90%	90%	90%	90%
Minimum time coverage:	14% ⁽⁴⁾	14% ⁽³⁾	14% ⁽⁴⁾	14% ⁽⁴⁾	> 10% in summer
Modelling uncertainty:					
Hourly	50%	–	–	–	–
8-hour averages	–	–	50%	–	–
Daily averages	50%	–	–	not yet defined	50%
Annual averages	30%	50%	–	50%	50%
Objective estimation:					
Uncertainty	75%	100%	75%	100%	75%

(1) Random measurements may apply instead of continuous monitoring for benzene and particulate matter, if it can be demonstrated that the measurement uncertainty, including the uncertainty due to random sampling, meets the data quality objective of 25% and the time coverage is still larger than the minimum time coverage for indicative measurements. Random measurements must be evenly distributed over the year in order to avoid skewing of results. The uncertainty due to random sampling may be determined by the procedure laid down in

ISO 11222 (2002) »Air Quality – Determination of the Uncertainty of the Time Average of Air Quality Measurements«. If random measurements are used to assess the number of exceedances of the PM10 daily limit value ($N[\text{estimate}]$), the following correction should be applied: $N[\text{estimate}] = N[\text{measurement}] \times 365 \text{ days} / \text{number of measured days}$.

(1a) Indicative measurements means measurements which are not regular, but complete the quality objectives of other measurement data.

(2) Distributed over the year so as to be representative of various conditions for climate and traffic.

(3) One day's measurements during the week at random, evenly distributed over the year, or 8 weeks evenly distributed over the year.

(4) One measurement a week at random evenly distributed over the year, or 8 weeks evenly distributed over the year.

Table 2:

	Benzo(a)pyrene	As, Cd, Ni	PAU ⁽¹⁾ except benzo(a)pyrene and total gaseous	Total deposition
Uncertainty	50%	40%	50%	70%
Fixed or indicative measurements				
Modelling	60%	60%	60%	60%
Minimum data capture	90%	90%	90%	90%
Minimum time coverage:				
– fixed measurements	33%	50%	–	–
– indicative measurements	14%	14%	14%	33%

(1) Polycyclic aromatic hydrocarbons

The uncertainty of the methods used for air concentrations assessment (expressed at a 95% confidence level) shall be evaluated in accordance with the principles of the CEN Guide to Expression of Uncertainty in Measurement (ENV 13005-1999), the methodology of ISO 5725:1994 and the guidance provided in CEN report »Air Quality – Approach to Uncertainty Estimation for Ambient Air Reference Measurement Methods« (CR 14377:2002E). The percentages in the above table are given for individual measurements averaged over the period considered by the limit values, i.e. target values, for a 95% confidence interval. The uncertainty for the fixed measurements shall be interpreted considering the appropriate limit value, i.e. target value. Fixed and indicative measurements must be evenly distributed over the year in order to avoid skewing of results.

The uncertainty for modelling and objective estimation is defined as the maximum deviation of the measured and calculated concentration values, over the period considered, by the limit/target value, without taking into account the timing of the events.

Requirements for minimum data capture and time coverage do not include losses of data due to regular calibration and maintenance of the instruments.

The measurement of benzo(a)pyrene and other polycyclic aromatic hydrocarbons requires 24-hour-long sampling (daily sampling). Individual samples taken over a one month period may be carefully combined and analysed as a complex sample, as long as the method provides stable samples during this period. The three related compounds: benzo(b)fluoranthene, benzo(j)fluoranthene and benzo(k)fluoranthene may be difficult to analyse separately. In such cases, they may be given as a total sum. 24-hour-long sampling (daily sampling) is recommended for determining the concentrations of arsenic, cadmium and nickel. Sampling must be evenly distributed over work days and throughout the year.

Monthly or weekly sampling over the year is recommended for determining the deposition quantity. Data obtained by applying the wet deposition method may be used instead of bulk deposition, if it can be proved that the difference between wet and bulk deposition does not exceed 10%. The deposition measuring unit shall be $\mu\text{g}/\text{m}^2$ per day.

Data time coverage lower than the value laid down in Table (b) may be applied, as long as it stays above 14% for fixed measurements and 6% for indicative measurements, also ensuring 95% uncertainty for average annual value calculated in compliance with the data quality objectives listed in the Table, and in accordance with ISO 11222:2002 – »Determination of uncertainty of the time average of air quality measurement« standard.

Conditions for application of the air quality model: When an air quality model is used for assessment, the model uncertainty data must be enclosed to the model description. The modelling uncertainty shall be defined as a maximum deviation of the measured and calculated concentration levels over the year, without taking into account the timing of the events.

Conditions for implementation of objective assessment methods: when using the objective assessment methods, uncertainty must not exceed 100%.

Standardisation: Analysis of matter concentrations in particulate matter PM₁₀ shall depend on the air volume during sampling. The sampling volume shall refer to ambient conditions.

B. RESULTS OF AIR QUALITY ASSESSMENT

Regardless of the measurements, air quality assessment in zones and/or agglomerations requires additional information on:

- activities carried out for the purposes of the assessment;
- applied methods, with references to description of the methods;
- the sources of data and information;
- a description of results, including uncertainties and, in particular, the extent of any area or, if relevant, the length of road within zone or agglomeration over which concentrations exceed any limit or tolerant values, if applicable, and of any area within which concentrations exceed the upper assessment threshold or the lower assessment threshold;
- the size of population potentially exposed to levels in excess of any limit value.

C. QUALITY ASSURANCE FOR AIR QUALITY ASSESSMENT – DATA VALIDATION

1. To ensure accuracy of measurements and compliance with the data quality objectives laid down in Chapter A of this Annex, it is necessary to ensure:

- access to all measurements undertaken in relation to the assessment of air quality;
- that institutions operating networks and individual stations have an established quality assurance and quality control system, and provide for regular maintenance to assure the accuracy of measuring devices;

- that a quality assurance and quality control process is established for the process of data collection and reporting and that institutions appointed for this task actively participate in the related EU-wide quality assurance programmes;
 - that the national laboratories accredited according to EN ISO/IEC 17025 standard, take part in intercomparison programmes covering all pollutants and measurement methods being verified in these intercomparisons. The accredited laboratories shall, on national level, coordinate the appropriate implementation of reference methods and the demonstration of equivalence of non-reference methods.
2. All reported data shall be deemed valid.

PROVISIONAL TRANSLATION