



BSI Standards Publication

Ambient air — Method for the determination of the concentration of nitrogen dioxide by diffusive sampling

National foreword

This British Standard is the UK implementation of EN 16339:2025. It supersedes BS EN 16339:2013, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EH/2/3, Ambient atmospheres.

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Ambient air - Method for the determination of the concentration of nitrogen dioxide by diffusive sampling

Air ambiant - Méthode de détermination de la concentration en dioxyde d'azote au moyen d'échantillonneurs par diffusion

Außenluft - Bestimmung der Konzentration von Stickstoffdioxid mittels Passivsammler

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European foreword

This document (EN 16339:2025) has been prepared by Technical Committee CEN/TC 264 “Air quality”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2025, and conflicting national standards shall be withdrawn at the latest by October 2025.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document will supersede EN 16339:2013.

A list of the significant technical changes compared to EN 16339:2013 can be found in Annex G.

EN 16339:2025 includes the following significant technical changes with respect to EN 16339:2013:

- 4.2 and Annex A: examples of demonstration of equivalence with respect to the reference method are provided;
- 4.3 and Annex F: protective devices have been described including the advantages over the conventional design of samplers;
- Annex D: More contemporary data included for the equivalence method determination of the measurement uncertainty;
- Annex D: Sampling rates have been updated.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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Introduction

EU Directive 2008/50/EC [1] stipulates that European Union Member States apply measurement methods for air quality pollutants (fixed measurement, modelling, indicative measurement, objective estimation) and associated Data Quality Objectives (DQO), depending on concentrations observed in different situations. Diffusive sampling is most often used as “indicative measurement”. The methodology described in this document has been developed to ensure the possibility for diffusive sampling to partially substitute and supplement fixed monitoring (where the reference method being that described in EN 14211 [2] is used) as a tool for the assessment of nitrogen dioxide (NO₂) with corresponding DQO.

Instead of the reference method, users may employ any other method which has been demonstrated to be equivalent according to the Guide for the Demonstration of Equivalence (GDE) [3]

Diffusive sampling is an attractive alternative to fixed monitoring by reference methodology (described in EN 14211) for the measurement of NO₂. This is due to:

- small size of diffusive samplers;
- no requirement for electric power;
- potential for covering areas with a high spatial density;
- cost effectiveness.

Consequently, diffusive samplers can partially substitute and supplement fixed monitoring as a means for the assessment of air quality, provided that they fulfil the specific DQO given in [1].

Passive samplers can be used for indicative measurements to complement air quality networks, improve modelling techniques and other air quality assessments, such as NO₂ concentrations for comparing with UNECE Critical Levels (annual mean of 30 µg NO_x/m³, expressed as a NO₂ equivalent) for the protection of vegetation and natural ecosystems [4] [5] [6].

A demonstration of equivalence according to [3] has been performed by the North Rhein-Westphalia state agency for nature, environment and consumer protection (LANUV) [7]. Some studies have compared NO₂ annual average concentrations measured by chemiluminescence and by diffusive samplers [8], [9], [10] and [11]. These have shown the potential of diffusive sampling to meet the data quality objective of 15 % expanded uncertainty for fixed measurements [1].

The methodology described in this document can be applied to obtain air quality information with a relatively high spatial density that can be used to complement the appropriate siting of fixed monitoring stations, or in the validation of dispersion models.

This document has been prepared based on the findings of reviews of implemented diffusive samplers in the European Union [12].

The methodology described in this document may also be used to determine NO₂ in indoor air. Appropriate strategies for NO₂ measurement in indoor air are described in EN ISO 16000-15 [13].

1 Scope

This document specifies a method for the sampling of NO₂ in ambient air using diffusive sampling followed by extraction and analysis by colourimetry or ion chromatography (IC). It can be used for the NO₂ measurement in a concentration range of approximately 3 µg/m³ to 130 µg/m³ [12]. A sample is typically collected for a period of 1 to 4 weeks [14], with exposure periods depending on the design of the samplers and the concentration levels of NO₂.

Several sorbents can be used for trapping NO₂ in ambient air using a diffusive sampler [15]. This document specifies the application of triethanolamine as the reagent.

This document describes the application of a tube-type sampler (with either a cylindrical or a slightly conical tube), a badge-type sampler and a radial-type sampler.

The relative expanded uncertainty of NO₂ measurements performed using these tube-type diffusive samplers can potentially be lower than 25 % for individual measurements. When aggregating results to form annual average values, the relative expanded uncertainty can be further reduced to levels below 15 % due to the reduction of random effects on uncertainty [9].

NOTE NO₂ passive samplers are also employed to measure NO_x with the addition of an oxidant to convert ambient NO into NO₂. A second NO₂ sampler is also deployed without the oxidant and the concentration of NO is determined from the difference of the two samplers [16].

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 13528-2, *Ambient air quality - Diffusive samplers for the determination of concentrations of gases and vapours - Requirements and test methods - Part 2: Specific requirements and test methods*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1 sampling period

period of time for which the measuring procedure yields a single value

[SOURCE: EN 482:2021 [17]]

3.2 combined standard uncertainty

standard measurement uncertainty [3.11] that is obtained using the individual standard measurement uncertainties associated with the input quantities in a measurement model

[SOURCE: JGCM 200:2012, 2.31 [18]]

3.3**efficiency of extraction**

ratio of the mass of analyte desorbed from a sampling device to that applied

[SOURCE: EN 13528-2:2002 [19]]

3.4**diffusive sampler**

device which is capable of taking samples of gases from the atmosphere at a rate controlled by a physical process such as gaseous diffusion through a static air layer or a porous material and/or permeation through a membrane, but which does not involve the active movement of air through the device

Note to entry: Active normally refers to the pumped movement of air.

[SOURCE: EN 13528-1:2002, 3.6 [20], modified, Note 2 to entry deleted.]

3.5**diffusive sampling rate**

rate at which the diffusive sampler collects a particular gas from the atmosphere

Note 1 to entry: The diffusive sampling rate is usually expressed in volume flow units of (m^3/h), (ml/min) or (cm^3/min).

Note 2 to entry: cm^3/min may be converted to SI units of m^3/s by factor $1,67 \times 10^{-8}$.

Note 3 to entry: The term “diffusive sampling rate” is sometimes referred to as “diffusive uptake rate”.

3.6**expanded measurement uncertainty****expanded uncertainty**

product of a combined standard measurement uncertainty and a factor larger than the number one

Note 1 to entry: The factor depends upon the type of probability distribution of the output quantity in a measurement model and on the selected coverage probability.

Note 2 to entry: The term “factor” in this definition refers to a coverage factor.

[SOURCE: JCGM 200:2012, 2.35 [18]]

3.7**field blank**

sealed sampler drawn from the same batch as the samplers being used for NO_2 monitoring, which is taken unopened to the field, remains closed during the sampling period at the measurement location and is returned together with exposed samplers after the sampling is completed

Note 1 to entry: This blank is only used for quality control purposes.

Note 2 to entry: A transport blank is considered to be a special case of a field blank. A transport blank is taken to the exposure site, left unopened and returned to the laboratory immediately after placement or collection of the samplers. Transport blanks may be used when regular field blanks reveal an unacceptable level of nitrite (NO_2^-) to investigate the possibility of contamination of samplers during transport.

3.8

laboratory blank

sealed sampler drawn from the same batch as the samplers being used for NO₂ monitoring which is stored in the laboratory for the duration of the sampling period and is analysed at the same time as the returned exposed samplers

3.9

mass concentration

mean concentration during the sampling period (averaging time) which is expressed in µg/m³

3.10

measurement uncertainty

uncertainty (of measurement)

non-negative parameter characterizing the dispersion of the quantity values being attributed to a measurand, based on the information used

Note to entry: For footnotes to the definition the reader is referred to the parent document JGCM 200:2012.

[SOURCE: JCGM 200:2012, 2.26 [18]]

3.11

standard measurement uncertainty

standard uncertainty

measurement uncertainty expressed as a standard deviation

[SOURCE: JCGM 200:2012, 2.30 [18]]

4 Description of samplers

4.1 Principle

The diffusive sampler is exposed to air for a measured time period, i.e. the exposure time. Controlled by the sampler's specific diffusive sampling rate, NO₂ migrates through the sampler diffusion path and is collected as nitrite by reaction with triethanolamine (TEA). The nitrite formed in the sampler is subsequently extracted and analysed in a laboratory. Based on the amount of nitrite determined, the diffusive sampling rate and the exposure time, the time-integrated average concentration of NO₂ can be calculated.

A number of pathways have been proposed for the reaction of nitrogen dioxide with triethanolamine. More details can be found in [21].

The diffusive sampling rate is determined either by calculation based on Fick's first law of diffusion or through calibration by exposure to standard atmospheres, and/or by field comparison of diffusive samplers measurements with measurements carried out using the EU reference method (EN 14211). This latter approach has been described in [8], [9], [10] and [22]. Values of and formulas to calculate diffusive sampling rates associated with different diffusive samplers are given in Annex C.

NOTE The theory of performance of diffusive samplers is given in EN 13528-3 [23, under revision] together with information on possible saturation of the sorbent, the effect of transients and the effect of face velocity. This document explains the dependence of diffusive sampling rates on the concentration level of pollutants and sampling time.

4.2 Diffusive samplers

4.2.1 Description

In general, three types of diffusive samplers are available with different designs: tube-type, radial-type and badge-type:

- Descriptions of the tube-type sampler with cylindrical and with conical tube are given in Annex A. The descriptions hold for sampler designs that have a proven practical validity.
- A radial-type sampler exists and is widely used in the EU. Validation data are available for this sampler [12], [24]. The sampler is described in the informative B.1.
- A badge-type NO₂ diffusive sampler exists that is based on the application of triethanolamine. Validation data are available for this sampler [12], [25], and [26]. The sampler is described in the informative B.2.

The sampler may include a protective device (4.3) in order to reduce environmental effects during sampling.

When a protective device is considered an integral part of the sampler, the performance of the sampler shall be validated including the protective device.

4.2.2 Preparation

The preparation of the sampler consists of the coating of a support with triethanolamine from a solution in water, methanol or acetone.

TEA is coated onto a suitable support. Supports that have been demonstrated to be suitable in practice are (see Annex A):

- a series (2 or 3) of circular stainless steel grids with a fine mesh size;
- a cylindrical stainless steel grid with a fine mesh size;
- a cellulose-fibre filter.

To this TEA solution a wetting agent may be added to facilitate the coating (see 4.2.2.4). In principle, one of the procedures specified in Annex A shall be used for the coating.

Preparation procedures are taken from references describing tube-type samplers with a cylindrical tube. Three preparation methods are given in Annex A. These preparation methods have proven to be effective in practice. Other methods may be used provided that their suitability has been satisfactorily demonstrated.

All reagents used shall not contain nitrite impurities higher than the laboratory blank values.

4.2.2.1 Triethanolamine (TEA)

Purity ≥ 99 %. TEA has a melting point of approximately 20 °C depending on its purity. When using volumetric techniques for measuring quantities of TEA, the TEA should be handled at temperatures well above its melting point. Alternatively, gravimetry may be used.

4.2.2.2 Acetone

Purity $\geq 99,9$ %. For the preparation of TEA coating solutions.

4.2.2.3 Ultrapure water

For the preparation of TEA coating solutions. Its conductivity shall be equal or less than 0,1 $\mu\text{S}/\text{cm}$.

4.2.2.4 Wetting agent compound

A wetting agent, for example polyoxyethyleneglycol dodecyl ether, CAS no. 9002-92-0 [27], [28], may be used for the preparation of TEA coating solutions.

NOTE This compound is commonly denominated as “Brij® 35”¹.

4.2.3 Storage of samplers before and after sampling

Manufacturer’s instructions for storage and sealing shall be followed.

Typically, samplers are stored in the dark under controlled conditions below room temperature in order to minimize any undesired reactions.

Although samples may be stable for up to 4 months [29] when stored under the above conditions, it is strongly recommended to analyse the samples as soon as possible after exposure.

If samples are not stored in accordance with the recommendations, including during travel, the end user shall regularly check the impact on the quality of the measurements from the analysis of the appropriate blanks.

4.2.4 Chemical interferences

Nitrous acid and peroxyacetyl nitrate are the major chemical interferences of sorption by triethanolamine. However, in ambient air monitoring both contaminants are generally present at low concentrations relative to NO_2 . Moreover, these species can also interfere with the measurement of NO_2 when applying the EU reference method for NO_2 monitoring based on chemiluminescence (see [2] [30]).

4.3 Protective devices

4.3.1 General

Protective devices are used to reduce the measurement uncertainty with NO_2 diffusive samplers. Protective shelters or protective filters can be used, alone or in combination.

NOTE The combined use of shelters and filters demonstrated equivalence to the reference method according to the Directive (study LANUV [7]).

Examples of validation data are given in Annex F.

Protective devices shall be used consistently over time when measuring at a specific site for a prolonged period, or over space when performing monitoring campaigns, in order to ensure the internal consistency of sampler behaviour.

4.3.2 Protective shelter

It is strongly recommended to use a protective shelter to prevent:

- the entrance of particulate matter (PM) or water droplets (rain) into the sampler during sampling;
- exposure to direct sunlight;

¹ Brij® is a trademark of ICI America Inc. This information is given for the convenience of users of this document and does not constitute an endorsement by CEN of the product named.

- exposure to high wind velocities.

NOTE 1 EN 13528-3 [23, under revision] gives general recommendations for the design of protective devices.

NOTE 2 In Annex A protective devices are described for the tube-type samplers; in Annex B protective devices are described for the other samplers.

4.3.3 Protective filter

It is strongly recommended to use a protective filter at the air inlet of the diffusive sampler to prevent or reduce:

- the effect of wind on the diffusive sampling rate, e.g. wind-shortening;
- biological contamination;
- PM contamination.

In literature the term ‘membrane’ is commonly and interchangeably used for a filter. The user should ensure that the relevant term has been applied correctly to the devices deployed.

NOTE In Annex A protective filters are described for the different samplers. Examples of protective filters include a gas permeable, hydrophobic filter, or a stainless steel mesh across the air inlet.

The manufacturer’s recommended filter shall be used if available. Otherwise, the end user shall check any alternative used against the reference method to ensure that there are no sample losses of NO₂.

Typically, the diffusive sampling rate is reduced when applying a filter at the open end of the sampler.

Metal meshes are also used to reduce wind-induced effects [31].

4.4 Instructions for use

The manufacturer shall make available a manual or instruction sheet for the handling of the samplers. These shall be followed in order to ensure proper operation of the sampler. Samplers shall be deployed vertically with the air inlet end (open or covered with a protective filter) facing the ground.

5 Analysis

5.1 General

There are two commonly used methods employed to analyse for nitrite (NO₂⁻) in the aqueous extract:

- colourimetry after derivatization of the nitrite, using the Griess-Saltzman method [27] [32];
- ion chromatography [28].

The mass of nitrite on the exposed samplers is related directly to NO₂.

Further details about reagents and equipment are described in Annex E.

For each technique employed, a calibration curve shall be established by performing linear regression of the analytical responses observed against the concentrations of nitrite in the standard solutions. For each concentration except zero the lack of fit of linearity of the calibration curve shall be calculated from the relative residuals of the regression formula as:

$$\delta_i = \left| 1 - \frac{a + b \cdot c_i}{y_i} \right| \quad (1)$$

where

- δ_i is the relative residual of the regression for calibration standard i ;
- Y_i is the analytical response for the analysis of calibration standard i ;
- a is the intercept of the linear regression formula;
- b is the slope of the linear regression formula;
- c_i is the concentration of nitrite in calibration standard i .

The relative residuals shall fulfil the requirements given in Table D.1.

If matrix effects are observed, calibration standards shall be prepared in diffusive samplers with TEA.

The detection limit is 3 times the relative standard deviation of the mean laboratory blank value. The quantification limit is typically in the range between 6 to 10 times the relative standard deviation of the mean laboratory blank value.

5.2 Colorimetric method

5.2.1 General

The Griess-Saltzman derivatization method consists of reacting nitrite with a mixture of sulphanilamide and N-(naphthyl-1) ethylenediamine dihydrochloride in dilute orthophosphoric acid (see Annex E). The absorbance of the azo dye formed is measured between 537 nm and 542 nm.

5.2.2 Calibration

Calibration shall be performed by analysing a series of solutions of nitrite in mixed reagent.

A full calibration shall include at least 6 calibration standards. It is recommended to use concentrations of the calibration standards of zero (this refers to the colorimetric reagent), 0,1 µg/ml, 0,2 µg/ml, 0,4 µg/ml, 0,6 µg/ml, 0,8 µg/ml and 1,0 µg/ml of nitrite. Higher concentrations are not recommended because of potential problems with linearity [33].

The expanded uncertainty of all diluted nitrite standards shall be equal to or less than 2 %. All potential sources of uncertainty shall be included in the calculation (e.g. impurities, volumes of all glassware used, uncertainty of nitrite concentration in a certified sodium nitrite solution).

5.2.3 Extraction

The extraction shall be performed by adding the colorimetric reagent to the TEA support.

NOTE In practice, when applying colourimetry, the derivatization agent solution is directly used for extraction.

The samples shall be secured against NO₂ contamination from the laboratory air during extraction (e.g. by using caps for the extraction vessels or samplers).

The extraction shall be carried out by using a vortex mixer or vibrating tray, followed by at least 1 h of standing at ambient temperature for colour development, avoiding exposure to direct sunlight.

If the extraction can be made by other means, the laboratory will have to prove that other means are sufficient to extract the whole. This shall be done in accordance with the requirements on the desorption efficiency in EN 13528-2.

A vertical movement is needed to reach a good mixing state.

The extraction conditions and extract stabilities are given in Table 1.

Table 1 — Extraction conditions and extract stabilities for analysis by colourimetry

Sampler type	Type and volume of extract	Extraction conditions	Extract stability
Tube-type sampler with a cylindrical tube	3 ml of mixed reagent in the sampler (see Annex E)	Agitate by vortex mixing for about 15 s immediately after adding the reagents.	2 days at 0 °C - 4 °C avoiding exposure to direct sunlight
Tube-type sampler with a slightly conical tube	2 ml of mixed reagent in the sampler (see Annex E)	Another possibility to extract the tubes is to use a vibrating tray for 10 min to 30 min. Be sure that no air bubbles are present in the solution to be analysed	

5.2.4 Analysis

Set up the colourimeter in accordance with the manufacturer's instructions. Set the measurement wavelength between 537 nm and 542 nm.

NOTE A commonly used wavelength is 540 nm. However, the use of other wavelengths within the above range has been reported in guidance documents and protocols (see [12]).

Use a calibrated colourimeter to analyse derivatized samples and blanks. Determine the responses of the samples and blanks and calculate from the calibration function the mass of nitrite in the desorbed samples and blanks.

If the instrument response to a sample exceeds the calibration range, the sample shall be diluted with mixed reagent to bring its concentration within the calibration range.

5.3 Ion chromatography method

5.3.1 General

For ion chromatography, the extraction of nitrite is performed in the sampler by adding a suitable eluent.

5.3.2 Calibration

Calibration shall be performed by analysing a series of solutions of nitrite in water or eluent.

A full calibration shall include at least 6 calibration standards.

For ion chromatography it is recommended to use concentrations of the calibration standards of 0,0 µg/ml, 0,1 µg/ml, 0,2 µg/ml, 0,4 µg/ml, 0,8 µg/ml, 1,5 µg/ml and 2,0 µg/ml of nitrite. The nitrite concentrations shall be traceable to primary standards. The uncertainty requirement shall follow the approach described in Clause 5.2.2

5.3.3 Extraction

The extraction shall be performed by adding ultrapure water or eluent to the TEA support. The volume of the extraction solution is given in Table 2.

The samples shall be secured against NO₂ contamination from the laboratory air during extraction (e.g. by using caps for the extraction vessels or samplers).

The extraction shall be carried out by using a vortex shaker or vibrating tray.

Extraction can be made by other means, the laboratory will have to prove that other means are sufficient to extract the whole. This shall be done in accordance with the requirements on the desorption efficiency in EN 13528-2.

The reported stabilities of the extracts are given in Table 2.

Table 2 — Extraction conditions and extract stabilities for analysis by ion chromatography

Sampler type	Type and volume of extract	Extraction conditions	Extract stability
Tube-type sampler with both a cylindrical and a slightly conical tube	5 ml of water or eluent	Agitate by vortex shaking for about 1 min to 2 min. Another possibility is to use a vibrating tray for 10 min to 30 min	One week in the dark at 0 °C - 4 °C

5.3.4 Analysis

Set up the ion chromatograph in accordance with the manufacturer's instructions. Use a calibrated ion chromatograph to analyse samples and blanks. Determine the responses of the samples and blanks and calculate from the calibration function the mass of nitrite in the desorbed samples and blanks.

If the instrument response to a sample exceeds the calibration range, the sample shall be diluted with water or eluent to bring its concentration within the calibration range.

The expanded uncertainty of all diluted nitrite standards shall be equal to or less than 2 %. All potential sources of uncertainty shall be included in the calculation (e.g. impurities, volumes of all glassware used, uncertainty of nitrite concentration in a certified sodium nitrite solution).

Stock standard solutions of 1 000 µg/ml can be purchased as certified solutions from different manufacturers or can be prepared by the laboratory.

6 Calculation of the concentration of nitrogen dioxide

6.1 Diffusive sampling rate

The diffusive sampling rate for the type of diffusive sampler is needed to calculate the mass concentration of NO₂ in ambient air. The diffusive sampling rate is determined by the geometry (see C.1.) of the diffusive sampler and is proportional to the diffusion coefficient of NO₂ in ambient air:

$$v = f(D) \quad (2)$$

where

v is the diffusive sampling rate in m³/h;

D is the diffusion coefficient in m²/h.

The diffusion coefficient (see [35]) is a function of temperature and pressure:

$$D = f(T^{n+1}, P^{-1}) \quad (3)$$

where

- D is the diffusion coefficient in m^2/h ;
- T is the temperature in K;
- P is the pressure in kPa;
- n is an empirically determined parameter, with $0,5 < n < 1,0$.

Hence, the diffusive sampling rate is a function of temperature and pressure [23, under revision]:

$$v = f(T^{n+1}, P^{-1}) \quad (4)$$

The reference conditions, i.e. temperature and pressure, to which the diffusive sampling rate relates, need to be known as those conditions are reflected in the mass concentration. If actual temperature and pressure during the sampling time deviate from the reference conditions of the diffusive sampling rate and data of average temperature and/or pressure is available, the diffusive sampling rate shall be corrected using Formula (5):

$$v = v_{\text{ref}} \cdot \left(\frac{T}{T_{\text{ref}}} \right)^{1,81} \cdot \left(\frac{P_{\text{ref}}}{P} \right) \quad (5)$$

where

- v is the diffusive sampling rate at actual conditions in m^3/h ;
- v_{ref} is the diffusive sampling rate at reference conditions in m^3/h ;
- T is the average temperature during exposure in K;
- T_{ref} is the reference temperature at which the diffusive sampling rate is given in K;
- P is the average pressure during exposure in kPa;
- P_{ref} is the reference pressure at which the diffusive sampling rate is given in kPa.

NOTE 1 Reference conditions of a diffusive sampling rate typically refer to the annual mean conditions of a region or country if determined by calibration in the field. Diffusive sampling rates which were determined in the laboratory or available from commercial suppliers of diffusive samplers often refer to standard conditions, such as 293 K and 101,3 kPa.

NOTE 2 The pressure difference is typically small and can often be neglected. At higher altitudes, for example in the mountains, the pressure difference can be considerable.

6.2 Mass concentration

The mass concentration of NO_2 in ambient air under actual conditions of sampling is calculated using Formula (6):

$$C = \frac{m_s - m_b}{e \cdot v \cdot t} \quad (6)$$

where

- C is the mass concentration of NO₂ at ambient conditions in µg/m³;
- m_s is the mass of nitrite found in the sample in µg;
- m_b is the mass of nitrite found in the mean laboratory blank in µg;
- v is the sampler diffusive sampling rate at actual conditions of sampling in m³/h;
- e is the efficiency of extraction of nitrite;
- t is the sampling time in h.

NOTE It is not necessary to include the efficiency of extraction of nitrite if this efficiency is shown not be significantly different from 100 % or if it is already included into the estimation of the diffusive sampling rate.

6.3 Conversion to standard conditions of temperature and pressure

The mass concentration of NO₂ in air is calculated at the ambient temperature and pressure during exposure using Formula (6). This mass concentration shall be referred to at standard conditions of temperature and pressure, as required by [1], using Formula (7):

$$c_{STP} = c \cdot \frac{T}{293} \cdot \frac{101,3}{P} \quad (7)$$

where

- c_{STP} is the concentration of NO₂ at standard temperature and pressure in µg/m³;
- c is the concentration of NO₂ at ambient conditions in µg/m³;
- T is the average temperature during exposure in K;
- P is the average pressure during exposure in kPa.

7 Quality control/quality assurance

For each series of analyses, the following control checks shall be performed and recorded. Corrective actions shall be taken in case of exceedance of limits set by the user, in order to ensure the quality of the NO₂ measurement results.

- a) Analysis of transport blanks and/or field blanks to detect contamination of samplers during transport, in the field and during subsequent storage prior to analysis;
- b) Analysis of calibration check solutions to determine instrument drift and appropriate re-calibration intervals. The calibration check shall be carried out using at least 3 points (zero, 50 % of calibration range and full scale) at the start of each day that samplers are analysed to detect any drift of the analytical system during a series of analyses.

At regular intervals, the following control checks shall be performed and registered. Corrective actions shall be taken in case of exceedance of limits set by the user, in order to ensure the quality of the NO₂ measurement results.

- c) Analysis of reagent solutions to determine variations of reagent blank levels;