SLOVENSKI STANDARD
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[Not translated]

Stationary source emissions - Determination of odour concentration by dynamic olfactometry and odour emission rate from stationary sources

Emissionen aus stationären Quellen - Dynamische Olfaktometrie zur Bestimmung von Geruchskonzentrationen

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English Version

Stationary source emissions - Determination of odour concentration by dynamic olfactometry and odour emission rate from stationary sources

Emissionen aus stationären Quellen - Dynamische Olfaktometrie zur Bestimmung von Geruchskonzentrationen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 264.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 13725:2019) has been prepared by Technical Committee CEN/TC 264 “Air quality”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 13725:2003.

This document is the first revised edition of the standard that was first published as EN 13725:2003. The method defined in this first edition and its quality criteria have been validated in numerous proficiency tests. This first revision contains modified and additional clauses on health and safety, sampling and emissions measurement, the use of additional reference materials and the assessment of overall uncertainty.

1 Scope

This document specifies a method for the objective determination of the odour concentration of a gaseous sample using dynamic olfactometry with human assessors. The standard also specifies a method for the determination of the emission rate of odours from stationary sources, in particular:

— point sources (conveyed or ducted emissions);

— active area sources (e.g. biofilters);

— passive sources.

The primary application of this standard is to provide a common basis for evaluation of odour emissions.

When this document is used for the determination of the odour concentration or the odour emission rate of stationary source emissions, the other relevant European Standards concerning stationary source emissions apply, in particular EN 15259 and EN 16911-1, especially when measurements have to be in compliance with the relevant European Directives concerning industrial air emissions.

Even so, the analysis/quantification step of the measurement method described in this document (i.e. the determination of the odour concentration of an odorous gas sample, without respect to the origin of the sample itself) can be fully applied in many cases not related with industrial emission sources (e.g. the measurement of the mass concentration at the detection threshold of pure odorous substances, the determination of effectiveness of deodorizing systems for indoor air). In those latter cases, the requirements in this document concerning the measurement planning and the sampling of stationary sources can be ignored or adapted.

This document is applicable to the measurement of odour concentration of pure substances, defined odorant compounds and undefined mixtures of odorant volatiles in air or nitrogen, using dynamic olfactometry with a panel of human assessors being the sensor. The unit of measurement is the European odour unit per cubic metre: ou_E/m^3. The odour concentration is measured by determining the dilution factor required to reach the detection threshold. The odour concentration at the detection threshold is by definition 1 ou_E/m^3. The odour concentration is then expressed in terms of multiples of the detection threshold. The range of measurement is typically from 10^1 ou_E/m^3 to 10^7 ou_E/m^3 (including pre-dilution).

The field of application of this document includes:

— the measurement of the mass concentration at the detection threshold of pure odorous substances in g/m^3;

— the determination of the EROM value of odorants, in mol;

— the measurement of the odour concentration of mixtures of odorants in ou_E/m^3;

— the measurement of the emission rate of odorous emissions from point sources, active area sources and passive area sources, including pre-dilution during sampling;

— the sampling of odorous gases from emissions of high humidity and temperature (up to 200 °C);

— the determination of effectiveness of end-of-pipe mitigation techniques used to reduce odour emissions.

The determination of odour emissions requires measurement of gas velocityto determine the gas volume flow rate.

The field of application of this document does not include:

— the measurement of odours potentially released by particles of odorous solids or droplets of odorous fluids suspended in emissions;

— the measuring strategy to be applied in case of variable emission rates;

— the measurement of the relationship between odour stimulus and assessor response above detection threshold (perceived intensity);

— measurement of hedonic tone (or (un)pleasantness) or assessment of annoyance potential;

— direct measurement of odour exposure in ambient air. For this measurement purpose, field panel methods exist which are the subject of CEN standard EN 16841-1, *Ambient Air - Determination of odour in ambient air by using field inspection - Grid method*;

— direct olfactometry, including field olfactometry;

— static olfactometry;

— measurement of odour recognition thresholds;

— measurement of odour identification thresholds.

Although the ultimate application of odour concentration measurement is aimed at reducing odour nuisance, the relation between emissions, dispersion, exposure and annoyance is not within the scope of this document. The relation between measured odour concentrations and odour emissions according to this standard and the occurrence of odour nuisance is highly complex. It is profoundly influenced by the atmospheric processes determining the dispersion of odours, the quality of the odour (hedonic tone) and finally by the receptor characteristics of those exposed to the odour. These receptor characteristics not only vary strongly between individuals, but also in time within one individual.

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 15259, *Air quality — Measurement of stationary source emissions - Requirements for measurement sections and sites and for the measurement objective, plan and report*

EN ISO 16911-1, *Stationary source emissions — Manual and automatic determination of velocity and volume flow rate in ducts - Part 1: Manual reference method*

EN ISO 20988:2007, *Air quality — Guidelines for estimating measurement uncertainty*

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 http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

The terms and definitions are categorized according to:

a) term and definitions for metrology and statistics;

b) terms and definitions for olfactometry;

c) terms and definitions for sampling.

3.1 Terms and definitions for olfactometry

3.1.1
anosmia
lack of sensitivity to olfactory stimuli

[SOURCE: EN ISO 5492:2008, 2.32]

3.1.2
assessor
somebody who participates in odour testing

3.1.3
delayed olfactometry
measurement of an odour with a time-lag between sampling and analysis

Note 1 to entry: The odour sample is preserved in an appropriate container.

3.1.4
detection threshold
<for a reference material> odorant concentration which has a probability of 0,5 of being detected under the conditions of the test

3.1.5
detection threshold
<for an odorant gas sample> dilution factor at which the odorant gas has a probability of 0,5 of being detected under the conditions of the test

3.1.6
dilution factor
ratio between flow or volume after dilution and the flow or volume of the odorous gas

3.1.7
dilution series
presentation of a sequence of dilutions to one panel member in order to obtain one Individual Threshold Estimate

Note 1 to entry: See Figure 1.

Note 2 to entry: One dilution series can consist of: one series of presentations, at odour concentrations where, when sorted in order of descending dilution factors, a significant change from FALSE responses to consistently TRUE responses occurs (see Figure 1).

3.1.8
direct olfactometry
on-line olfactometry
measurement of odour concentrations without any time-lag between the sampling (operation) and the analysis

3.1.9
dynamic dilution
dilution achieved by mixing two known flows of gas, odorous sample and neutral gas, respectively

Note 1 to entry: The rate of dilution is calculated from the flow rates.

3.1.10
dynamic olfactometer
equipment that delivers a flow of mixtures of odorous and neutral gas with known dilution factors in a common outlet

3.1.11
dynamic olfactometry
olfactometry using a dynamic olfactometer

3.1.12
European Odour unit
amount of odorant(s) that, when evaporated into one cubic metre of neutral gas at standard conditions, elicits a physiological response from a panel (detection threshold) equivalent to that elicited by one European Reference Odour Mass (EROM), evaporated in 1 m^3 of neutral gas at standard conditions

3.1.13
European Reference Odour Mass
EROM

conventional quantity value for the European odour unit, equal to a defined mass of reference odorant

Note 1 to entry: The primary reference odorant is n-butanol (CAS-Nr. 71-36-3). The conventional quantity value for 1 EROM is 123 µg n-butanol. Evaporated in 1 m^3 of neutral gas this produces a concentration of 0,040 µmol/mol.

Note 2 to entry: For each odorant a specific quantity for the EROM can be determined, according to the procedure in 5.3. If an EROM quantity has been established for an odorant, it can serve as a secondary reference odorant.

3.1.14
forced choice method
procedure in which the response “no difference” is not permitted

[EN 5492:2009/A1:2017, 4.58

3.1.15
group threshold
detection threshold applying to a group of assessors

3.1.16
identification threshold
recognition threshold
odour concentration which has a probability of 0,5 of being recognised under the conditions of the test

3.1.17
individual threshold
detection threshold applying to an individual

3.1.18
individual threshold estimate
ITE
detection threshold applying to an individual estimated on the basis of one dilution series

3.1.19
instrumental dilution range
range between the minimum and maximum dilution factor

3.1.20
intensity
magnitude of the perceived sensation

[SOURCE: ISO 5492:2008,2.8]

3.1.21
maximum dilution factor
highest settable dilution factor of the olfactometer

3.1.22
measurement report
report established by the testing laboratory according to the customer request and containing at least the information required in the standards applied in the measurements programme, in particular this European Standard

[SOURCE: EN 15259:2007, 3.22]

3.1.23
measuring range
<of an olfactometer> odour concentrations which can be measured by a specific olfactometer

Note 1 to entry: The measuring range depends on the minimum and maximum dilution factor and the step factor. The numerical values defining the measuring range are the minimum dilution factor multiplied with the step factor to the power 1,5 and the maximum dilution factor divided by the step factor to the power 1,5.

3.1.24
minimum dilution factor
the lowest settable dilution factor of the olfactometer

3.1.25
neutral gas
odourless gas
air or nitrogen that is treated in such a way that it is as odourless as technically possible and that does, according to panel members, not interfere with the odour under investigation

Note 1 to entry: Nitrogen is only used to predilute the sample itself. For the olfactometer, the neutral gas used to dilute the sample and present a reference shall be suitable for breathing by human subjects.

3.1.26
objective method
method in which the effects of personal opinions are minimized

[SOURCE: EN ISO 5492:2008, 4.1]

3.1.27
odorant
substance which, when volatilized in neutral gas, has the potential to stimulate the human olfactory system so that an odour is perceived

3.1.28
odorant gas
gas that contains one or more odorants

Note 1 to entry: The odour concentration of a generic odorant gas can be greater or lower than 1 ou_E/m^3, i.e. the odorants in the gas may or may not cause an odour for human olfactory assessors.

3.1.29
odorous gas
odorant gas having an odour concentration greater than 1 ou_E/m^3

3.1.30
odour

sensation perceived by means of the olfactory organ in sniffing certain volatile substances

[SOURCE: EN ISO 5492:2008, 3.18]

3.1.31
odour abatement efficiency
reduction of the odour flow rate due to an abatement technique, expressed as a fraction (or percentage) of the odour flow rate of the untreated gas stream

Note 1 to entry: Reduction of the odour concentration does not imply a proportional reduction of the perceivable odour intensity.

3.1.32
odour concentration
number of European odour units in a cubic metre of gas at standard conditions for olfactometry

3.1.33
odour detection
awareness of the sensation resulting from adequate stimulation of the olfactory system

3.1.34
odour panel
panel
group of panel members

3.1.35
odour unit
amount of (a mixture of) odorants present in one cubic metre of odorant gas (under standard conditions for olfactometry) at the panel threshold

Note 1 to entry: This definition is different from that of the European odour unit, in that only the latter is traceable to a known odorant mass, defined as the EROM".

3.1.36
olfactometer
apparatus in which a sample of odorant gas is diluted with neutral gas in a defined ratio and presented to assessors

3.1.37
olfactometric analysis of one odorous gas sample
presentation to all panel members of those dilution series necessary to produce sufficient data to calculate the odour concentration for one sample

Note 1 to entry: See Figure 1.

3.1.38
olfactometry
measurement of the odour concentration of an odorous gas sample by sensory analysis

Note 1 to entry: This definition is specific for use within the scope of this standard

3.1.39
olfactometry operator
person directly involved in operating the olfactometer and instructing the panel in olfactometry

3.1.40
olfactory
pertaining to the sense of smell

[SOURCE: ISO 5492:2008, 2.14]

3.1.41
olfactory receptor
specific part of the olfactory system which responds to one or several odorants

[SOURCE: EN ISO 5492:2008, 2.1, modified - general definition pertaining to sense organs adapted to be specifically applicable to olfaction]

3.1.42
olfactory stimulus
that which excites an olfactory receptor

[SOURCE: EN ISO 5492:2008, 2.2, modified – general definition adapted to be specifically applicable to olfaction]

3.1.43
panel member
assessor who is qualified to judge samples of odorous gas using dynamic olfactometry

3.1.44
panel screening
procedure to determine if the performance of panel members is in compliance with selection criteria

3.1.45
panel selection
procedure to determine which assessors are qualified as panel members

3.1.46
panel threshold
odour threshold
odour detection threshold applying to a panel

3.1.47
perception
awareness of the effects of single or multiple sensory stimuli

[SOURCE: EN ISO 5492:2008, 2.3]

3.1.48
presentation
presentation of one dilution to one assessor

Note 1 to entry: See Figure 1.

3.1.49
presentation series
presentation of one dilution to all panel members in one round

Note 1 to entry: See Figure 1.

3.1.50
presented gas flow
gas flow produced by the olfactometer and presented to the assessor

EXAMPLE 1 A diluted odorant gas sample.

EXAMPLE 2 Neutral gas.

3.1.51
round
presentation of one dilution series to all assessors

3.1.52
sensory adaptation
temporary modification of the sensitivity of a sense organ due to continued and/or repeated stimulation

[SOURCE: EN ISO 5492:2008 2.6]

3.1.53
sensory reference
presented gas flow to which the diluted sample is compared