SLOVENSKI STANDARD
SIST-TP CEN/TR 17965:2023

01-september-2023

Gradbeni proizvodi - Ocenjevanje sproščanja nevarnih snovi - Navodilo za širšo uporabo referenčne komore CEN/TC 351

Construction products - Assessment of release of dangerous substances - Guidance for a broader application of the CEN/TC 351 reference room

Bauprodukte - Bewertung der Freisetzung von gefährlichen Stoffen - Leitfaden für eine weiterführende Anwendung des CEN/TC 351 Referenzraums

Produits de construction - Evaluation de l'émission de substances dangereuses Guide pour une application à dautres domaines de la chambre de référence du CEN/TC 351

Ta slovenski standard je istoveten z: **CEN/TR 17965:2023**

ICS:

13.020.99	Drugi standardi v zvezi z varstvom okolja	Other standards related to environmental protection
13.040.20	Kakovost okoljskega zraka	Ambient atmospheres
91.100.01	Gradbeni materiali na splošno	Construction materials in general

SIST-TP CEN/TR 17965:2023 **en**

TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER REPORT

CEN/TR 17965

June 2023

ICS 13.040.20; 91.100.01

English Version

Construction products: Assessment of release of dangerous substances - Guidance for a broader application of the CEN/TC 351 reference room

Produits de construction : Évaluation de l'émission de substances dangereuses - Possibilités d'extension du champ d'application de la pièce de référence du CEN/TC 351

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This Technical Report was approved by CEN on 28 May 2023. It has been drawn up by the Technical Committee CEN/TC 351.

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Ref. No. CEN/TR 17965:2023 E

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European foreword

This document (CEN/TR 17965:2023) has been prepared by Technical Committee CEN/TC 351 “Construction products: Assessment of release of dangerous substances”, the secretariat of which is held by NEN.

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 has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

CEN/TC 351 prepared the European Standard EN 16516:2017+A1:2020 for the determination of emissions of volatile compounds from building products into indoor air. EN 16516:2017+A1:2020 also describes the method for the health-related evaluation of emissions using the concept of the so-called model room.

This document illustrates the potential use of the model room for the evaluation of emissions from indoor sources other than building products and/or for their intended use in reference indoor environments different from the reference room described in EN 16516:2017+A1:2020.

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.

Introduction

Determination of emissions of dangerous substances from building products into indoor air is carried out under their intended conditions of use. The intended condition of use of a construction product is generally specified in the corresponding harmonized product standard. The specific emission rates determined using EN 16516:2017+A1:2020 are associated with application of the product in a European Reference Room, under specified climate (temperature, relative humidity) and ventilation conditions. Converting the test results (Specific Emission Rates: SER) into concentrations in the air of a reference room is essential because it enables the comparison of those concentrations with reference values and facilitates the classification of product emissions on the basis of its potential impact on indoor air.

From a technical perspective the SER, as a product characteristic parameter, allows the calculation of the indoor exposure concentration deriving from any component (construction product, furniture, air fresheners, etc.) for any room scenario.

The intended conditions of use describe the purpose, place and circumstances of typical applications of a construction product as defined in a product standard. This includes the intended use (e.g. for what purpose, how is the product typically installed, etc.) and an emission scenario.

When determining emissions into indoor air, the emission scenario specifies the climate and ventilation conditions of the air surrounding the product in the reference room. The actual conditions of use in reality may be different, but it is not possible to evaluate emissions under all possible use scenarios. EN 16516 specifies a set of conditions that are generally agreed to be representative of the use of the product in "normal" indoor environments, such that all construction products can be evaluated under comparable conditions.

These defined conditions assume a standardized installation of the product in the reference room with standardized dimensions, climate and ventilation.

1 Scope

This document describes the concept of a reference room with respect to its application in the health-related evaluation of dangerous substance emissions from indoor products. The evolution of the reference room concept with respect to mandatory and voluntary labelling schemes for building products is outlined. The current limited application to other product types is described as well as the potential for broader application, either to additional products or for other exposure scenarios that may apply reference room/s with different characteristics.

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 16516:2017+A1:2020, *Construction products: Assessment of release of dangerous substances - Determination of emissions into indoor air*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16516:2017+A1:2020 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

4 Evaluation of VOC emissions from building products: Principles

The evaluation of volatile organic compounds (VOC) emissions from any indoor source with respect to their potential effects on health and comfort may be broken down into three main steps (adapted from JRC, ECA Report 18):

1) Characterization of VOC emissions from indoor sources into indoor air according to a standardized method,

2) Estimation of the exposure an individual may experience indoors due to emissions from a specific source (e.g. building products),

3) Evaluation of the effect of indoor exposure on human health.

This simplified risk assessment evaluation scheme is specified for the evaluation of VOC emissions from building materials using the following tools:

a) Characterization of VOC emissions from building products is performed using EN 16516:2017+A1:2020 which is based on parts of EN ISO 16000 and former ENV 13419 standards,

b) Estimation of the exposure to VOC emitted by building products is performed using the reference room concept,

c) Evaluation of the potential health effect of exposure to VOC emitted by building products is performed using the LCI concept[1].

NOTE As well as to VOC, EN 16516:2017+A1:2020 can be applied to determine other vapour phase organic compound emissions (very volatile and semi-volatile organic compounds) and can also be used to determine ammonia emissions.

EN 16516:2017+A1:2020 details calculation of specific emission rates and expression of results in a reference room.

Relevant test parameters are the following:

— c_i, the mass concentration of compound *i* sampled at the test chamber outlet (µg/m³);

— S_t, the emitting surface of the specimen placed in the emission test chamber (m²);

— VR_t, the ventilation rate of the test chamber (m³/h);

— V_t, the volume of the test chamber (m³).

The following definitions apply.

The air change rate in the test chamber, AC_t, is calculated according to Formula (1).

$$AC_t = \frac{VR_t}{V_t} \tag{1}$$

where

AC_t is the air change rate of the test chamber, in air changes/h;

VR_t is the ventilation rate of the test chamber, in m³/h;

V_t is the volume of the test chamber, in m³.

The loading factor in the test chamber, LA_t, is calculated according to Formula (2).

$$LA_t = \frac{S_t}{V_t} \tag{2}$$

where

LA_t is the loading factor in the test chamber, in m²/m³;

S_t is the emitting surface of the specimen placed in the emission test chamber, in m²;

V_t is the volume of the test chamber, in m³.

For the characterization of VOC emissions from building products, test results are generally expressed as area specific emission rates, SER_A. These are calculated according to Formula (3).

[1] Harmonized EU-LCI have been derived (https://ec.europa.eu/growth/sectors/construction/eu-lci/values_en)

$$SER_A = \frac{c_i \times AC_t}{LA_t} \quad (3)$$

where

SER_A is the area specific emission rate, in µg/m²·h;

c_i is the mass concentration of compound i sampled at the test chamber outlet, in µg/m³;

AC_t is the air change rate of the test chamber, in air changes/h;

LA_t is the loading factor in the test chamber, in m²/m³.

The ratio AC_t/LA_t is called area specific air flow rate, q_A. Hence SER_A can also be expressed as Formula (4).

$$SER_A = c_i \times q_A \quad (4)$$

where

SER_A is the area specific emission rate, in µg/m²·h;

c_i is the mass concentration of compound i sampled at the test chamber outlet, in µg/m³;

q_A is the area specific air flow rate, in m³/m²·h.

with

$$q_A = \frac{AC_t}{LA_t}$$

where

AC_t is the air change rate of the test chamber, in air changes/h;

LA_t is the loading factor in the test chamber, in m²/m³.

Using the same calculation principle, one can calculate concentrations resulting from emissions from a building product, with a SER_A experimentally determined, placed in any room provided that the following room parameters are known:

— Air change rate in the room, AC_R (air changes/h);

— Volume of the room, V_R (m³);

— Surface of the considered building product in the room, S_R (m²).

Then the loading factor in the room, LA_R, is calculated according to Formula (5).

$$LA_R = \frac{S_R}{V_R} \quad (5)$$

where

LA_R is the loading factor in the room, in m²/m³;

S_R is the emitting surface of the considered building product in the room, in m²;

V_R is the volume of the room, in m³.

The resulting concentrations in the room, c_R, also called exposure concentrations, can be calculated according to Formulae (6) to (8).

$$c_R = \frac{SER_A \times LA_R}{AC_R} \quad (6)$$

where

c_R is the concentration in the room, in µg/m³;

NOTE This parameter is also known as exposure concentration.

SER_A is the area specific emission rate, in µg/m²·h;

LA_R is the loading factor in the room, in m²/m³;

AC_R is the air change rate of the room, in air changes/h.

Or

$$c_R = \frac{SER_A}{q_R} \quad (7)$$

where

c_R is the concentration in the room, in µg/m³;

NOTE This parameter is also known as exposure concentration.

SER_A is the area specific emission rate, in µg/m²·h;

q_R is the specific air flow rate in the room, in m³/m²·h;

with

$$q_R = \frac{AC_R}{LA_R} \quad (8)$$

where

AC_R is the air change rate of the room, in air changes/h;

LA_R is the loading factor in the room, in m²/m³.

As a convention, EN 16516:2017+A1:2020 specified characteristics of a typical residential room, thereafter referred to as the reference room, with a 30 m³ volume (V_R = 30 m³) and a 0,5 air change per hour (AC_R = 0,5 air changes/h). Emitting surfaces (S_R) in the EN 16516:2017+A1:2020 reference room and corresponding loading factors (LA_R) and area specific air flow rates (q_R) are presented in Table 1.

Table 1 — Surfaces (S_R), loading factors (LA_R) and area specific air flow rates (q_R) for different indoor surfaces of the 30 m³ reference room

Indoor surfaces	S_R m²	LA_R m²/m³	q_R m³/m²·h
Floor	12	0,4	1,25
Ceiling	12	0,4	1,25
Walls (minus door and window)	31,4	1,0	0,5
1 door	1,6	0,05	10
1 window	2	0,07	7
Small surfaces (e.g. sealants)	0,2	0,007	70
NOTE These values are taken from EN 16516:2017+A1:2020.			

Calculation of exposure concentrations can be performed as soon as an area specific air flow rate (q_R) representative of the potential use of the considered product in an indoor environment has been defined.

5 Background history

The implementation of Essential Requirement (ER) N° 3 concerning Hygiene, Health and Environment within the Construction Product Directive (CPD) in 1989 was a legislative response at the European level to concerns about indoor air contamination in buildings, especially due to volatile organic compounds (VOC) emissions from building products.

Already in 1982, a “standard reference room“ had been defined, this being a room with a volume of 17 m³, a floor and ceiling surface of 7 m² and a height of 2,4 m (Mølhave et al.), and this was subsequently applied in national standards concerning determination and evaluation of VOC emissions from building products (DS/INF 90:1994) and Nordtest method (NT BUILD 358, 1990).

The European Concerted action on Indoor Air Quality and its Impact on Man (COST Project 613) and the subsequent European Collaborative Action over the time period of 1988-2013, documented in the “ECA Reports”, summarizes the state of research in the EU in the field of health related substances in interiors and provided the basis for the development of the harmonized test standard EN 16516:2017+A1:2020 for the assessment and evaluation of the emission of volatile organic compounds from construction products.

In the ECA-IAQ Report N° 18 (1997), the standard room is not explicitly described, but the ventilation (i.e. air exchange rate) within specifically used indoor rooms for three different exposure scenarios and area specific ventilation rates were described to be used for the toxicological and sensory evaluation of VOC emissions. The medium class scenario defines a ventilation rate of 0,5/h with an area specific ventilation rate of 1,25 m³/m²·h.

A European reference room first appeared in 1999 in ENV 13419-1 which was transposed in 2006 into EN ISO 16000-9:2006. Informative Annex B of EN ISO 16000-9:2006 presents examples of area specific air flow rates in a 17,4 m³ reference room (V_R = 17,4 m³) with a 0,5 air change per hour (AC_R = 0,5 air changes/h) (see Table 2).