



# SLOVENSKI STANDARD

## SIST EN 17637:2023

01-februar-2023

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### Gradbeni proizvodi - Ocenjevanje sproščanja nevarnih snovi - Ocenjevanje doze emitiranega gama sevanja

Construction products: Assessment of release of dangerous substances - Dose assessment of emitted gamma radiation

Bauprodukte - Bewertung der Freisetzung von gefährlichen Stoffen - Verfahren zur Beurteilung von emittierter Gammastrahlung

Produits de construction : Évaluation de l'émission de substances dangereuses - Évaluation de la dose de rayonnement gamma émis

Ta slovenski standard je istoveten z: **EN 17637:2022**

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#### **ICS:**

13.020.99	Drugi standardi v zvezi z varstvom okolja	Other standards related to environmental protection
13.280	Varstvo pred sevanjem	Radiation protection
91.100.01	Gradbeni materiali na splošno	Construction materials in general

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EUROPEAN STANDARD

EN 17637

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## Construction products: Assessment of release of dangerous substances - Dose assessment of emitted gamma radiation

Produits de construction : Évaluation de l'émission de substances dangereuses - Évaluation de la dose de rayonnement gamma émis

Bauprodukte - Bewertung der Freisetzung von gefährlichen Stoffen - Verfahren zur Beurteilung von emittierter Gammastrahlung

This European Standard was approved by CEN on 13 June 2022.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
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## European foreword

This document (EN 17637:2022) 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.

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of an identical text or by endorsement, at the latest by May 2023, and conflicting national standards shall be withdrawn at the latest by May 2023.

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 Standardization Request given to CEN by the European Commission and the European Free Trade Association.

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<https://standards.iteh.ai/catalog/standards/sist/e10020c6-5e9a-4064-9255-fc4cd9b45329/sist-en-17637-2023>

**EN 17637:2022 (E)****Introduction**

In January 2014 the Basic Safety Standards Directive (2013/59/Euratom) [1], also named EU-BSS, was issued laying down basic safety standards for the protection against the danger arising from exposure to ionising radiation. The directive also sets requirements on the gamma radiation dose from the naturally occurring radionuclides ( $^{226}\text{Ra}$ ,  $^{232}\text{Th}$  and  $^{40}\text{K}$ ) in building materials and must be taken into account along with the 2011 EU regulation laying down harmonized conditions for the marketing of construction products (EU no 305/2011) [2], so called CPR. Both EU regulatory documents constitute a new basis for radiation protection regulation of building materials and are to be complemented by EU guidance and standards of which this document (EN 17637) is part.

Pivotal in the regulatory system of the EU-BSS and CPR is the dose assessment of building materials and its compliance against a reference level as defined under Article 75 of the EU-BSS. For this purpose, an activity concentration index is provided in the directive under Annex VIII. The index value is determined using the material's massic activities of  $^{226}\text{Ra}$ ,  $^{232}\text{Th}$  and  $^{40}\text{K}$ . As the index is proposed as a conservative screening tool provisions are put in place under Annex VIII to allow for more precise assessment of the dose if needed. This includes consideration of the material's density, thickness and other factors relating to the type of construction and the intended use. However, no method for a more refined dose assessment is provided in the directive, despite the fact that various EU member states allow for such refined assessment. This EN document serves as a harmonized standard under the CPR to address the provisions in the EU-BSS for a more refined assessment.

This document is an addition to the activity concentration index as formulated in the Annex VIII of the EU-BSS. The method describes a dose assessment that takes account of all factors stipulated under Annex VIII of the directive. In the method, important consideration is given to differentiate between the dose from the individual construction product and the assembly of products that result in the dose from the model building. In the EU-BSS dose requirements are expressed in terms of a dose from the building, while the CPR is intended to set product specific requirements. For this reason, the method provides for a calculation of dose from the individual product, followed by a calculation of the product assembly with subtraction of terrestrial background dose to enable assessment against the reference level defined in Article 75 of the EU-BSS.

The document provides the following structure:

- A normative instruction on the use of the assessment method with description of the equations and parameters to be used, followed by a list of information to be reported;
- An informative annex with a description of the dose assessment model, including explanation of the modelling principles, main assumptions, coefficients and conversion factors;
- An informative annex containing a series of examples on the use of the assessment method.

## 1 Scope

This document describes a calculation method to determine the indoor gamma dose from construction products. The method includes calculation of the indoor gamma dose from the individual construction product under its intended use, as well as the dose from the building taking consideration of multiple building materials where this is deemed necessary and any shielding from the terrestrial background.

The calculation method builds on existing modelling principles for photon emission and absorption. Parameters of the modelling that are not product specific, such as room geometry, exposure coefficients, and conversion factors are predefined and form the underlying basis for the method in this EN. The choice for pre-defined model parameters is essential from a harmonization perspective, despite the fact that such parameters can vary considerably for every homeowner, building type, region or country. Typical examples are the exposure time, the location of exposure in the building, the terrestrial background radiation and the amounts and way the building materials are used in the building. The parameters are selected on the basis of international consensus, as laid down in ICRP, UNSCEAR, EU RP guidelines and other renowned publications. Product specific parameters such as density and thickness are specified in accordance with the product's intended use. In addition, the product's massic activities of  $^{226}\text{Ra}$ ,  $^{232}\text{Th}$  and  $^{40}\text{K}$  are specified and obtained according to prEN 17216<sup>1</sup> [3]. The method provides a tiered approach with a basic approach intended for assessing individual construction products, followed by a more refined approach to assess a complete building design. The former approach assumes an identical structure of building materials on all six surfaces of the model room, and where needed complemented with other building materials that form an intrinsic part of the product's intended use. The latter approach enables evaluation of a known building design. Here the user can specify the applied construction product to walls, floor or ceiling separately in accordance with the product's intended use.

The indoor gamma dose from the individual construction product as well as the building is expressed in terms of an annual effective dose from gamma radiation in the indoor environment. The formulation of the indoor gamma dose in the building is consistent with the dose for indoor external exposure as stated under Article 75 of the Basic Safety Standards Directive. As a result, the described method enables assessment of the calculated annual dose of the building against the reference level as defined in the Basic Safety Standards Directive<sup>2</sup>.

The method is designed for assessment of mineral based building materials applied in bulk or superficially and used as a construction product in buildings. This includes any building materials that have been identified by EU member states as being of concern from a radiation protection point of view. The method is envisaged for use by producers of building materials, architects and building constructors as well as authorities.

**NOTE** It is important to state that following the calculation of dose, any subsequent regulatory classification falls explicitly outside the scope of this method and is the responsibility of the relevant authorities.

## 2 Normative references

There are no normative references in this document.

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<sup>1</sup> Under preparation. Stage at the time of publication: prEN 17216:2022. Based on CEN/TS 17216:2018.

<sup>2</sup> In exceptional cases, this document can permit massic activities in the construction product that for its manufacturing, distribution and handling could be identified as a practice referred to in Article 23 of the EU-BSS [1]. In accordance with Article 24 of the Directive, such practice shall be notified and may be subject to further regulatory requirements in accordance with national provisions implementing the EU-BSS.

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### 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:

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

**3.1**  
**background subtraction**  
 mathematical operation to subtract the dose from terrestrial background gamma radiation from the external dose from gamma radiation emitted by building materials

Note 1 to entry: The subtraction takes account of the building materials' ability to shield the indoor environment from terrestrial background gamma radiation, and is required to obtain the indoor external dose from gamma radiation emitted by building materials, in addition to the outdoor external exposure, as described in Article 75 of the EU-BSS [1]. For the terrestrial background gamma radiation, a European surface area weighted average value of 60 nGy/h, which corresponds to 0,29 mSv per year for an occupancy time of 7 000 h, is assumed. The average background gamma radiation was calculated from data taken from the UNSCEAR 1988 and 2008 reports ([4], [5]).

Note 2 to entry: The principle of the dose criteria and subtraction of the terrestrial background gamma radiation in compliance with the EU-BSS [1] is illustrated in Figure 1.

**3.2**  
**building material**  
 any construction product for incorporation in a permanent manner in a building or parts thereof and the performance of which has an effect on the performance of the building with regard to exposure of its occupants to ionizing radiation

[SOURCE: 2013/59/EURATOM, chapter II, Article 4, (9) [1]]

**3.3**  
**building structure**  
 structure consisting of one or more building materials with either vertical or horizontal orientation or a combination of both, that separate the indoor space from the outdoor space or one space from another space in the building

**3.4**  
**bulk material**  
 building material not being a superficial material

**3.5**  
**default material**  
 building material with an assumed massic activity of 40 Bq/kg <sup>226</sup>Ra, 30 Bq/kg <sup>232</sup>Th and 400 Bq/kg <sup>40</sup>K

**3.6**  
**dose point**  
 geometrical point located in the centre of the room and the location for compliance of the effective dose



**3.7****effective dose  $E$** 

sum of the weighted equivalent doses in all the tissues and organs of the body from internal and external exposure

Note 1 to entry: The effective dose is defined by Formula (1):

$$E = \sum_T w_T H_T = \sum_T w_T \sum_R w_R D_{T,R} \quad (1)$$

where

- $E$  is the effective dose;
- $w_T$  is the tissue weighting factor for tissue or organ  $T$ ;
- $H_T$  is the equivalent dose absorbed by tissue or organ  $T$ ;
- $w_R$  is the radiation weighting factor;
- $D_{T,R}$  is the absorbed dose averaged over tissue or organ  $T$ , due to radiation  $R$ .

Note 2 to entry: The values for  $w_T$  and  $w_R$  are specified in Annex II of the EU-BSS [1].

Note 3 to entry: The unit for effective dose is the sievert (Sv).

[SOURCE: 2013/59/EURATOM, chapter II, Article 4, (25) [1]]

**3.8** **$^{40}\text{K}$** 

radionuclide potassium-40

**3.9****massic activity**

quotient of the activity  $A$  of a sample and the mass  $m$  of that sample

[SOURCE: EN ISO 80000-10:2019, 10-28 [6]]

**3.10****mass per unit area**

quotient of mass and area

**3.11** **$^{226}\text{Ra}$** 

radionuclide radium-226 and its progenies in secular equilibrium

**3.12****reference level**

level of effective dose or equivalent dose or massic activity above which it is judged inappropriate to allow exposures to occur as a result of that exposure situation, even though it is not a limit that may not be exceeded

[SOURCE: 2013/59/EURATOM, chapter II, Article 4, (84) [1]]

Note 1 to entry: The EU-BSS uses the term 'activity concentration'. In the documents of CEN/TC 351, it was agreed to use the term 'massic activity', in line with EN ISO 80000-10 [6].

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## 3.13

## sievert

## Sv

special name of the unit of equivalent or effective dose

Note 1 to entry: One sievert is equivalent to one joule per kilogram:  $1 \text{ Sv} = 1 \text{ J/kg}$ . Further details are provided under 3.7.

[SOURCE: 2013/59/EURATOM, chapter II, Article 4, (91) [1]]

## 3.14

## superficial material

building material located on the interior side of the building structure, applied as a protective layer and/or for decorative purposes, and characterised by a low mass per unit area

Note 1 to entry: Superficial materials such as joint-filler, coatings like paintings or any other building material with a restricted use within the building structure are not included.

## 3.15

<sup>232</sup>Th

radionuclide thorium-232 and its progenies in secular equilibrium

## 4 Symbols and abbreviated terms

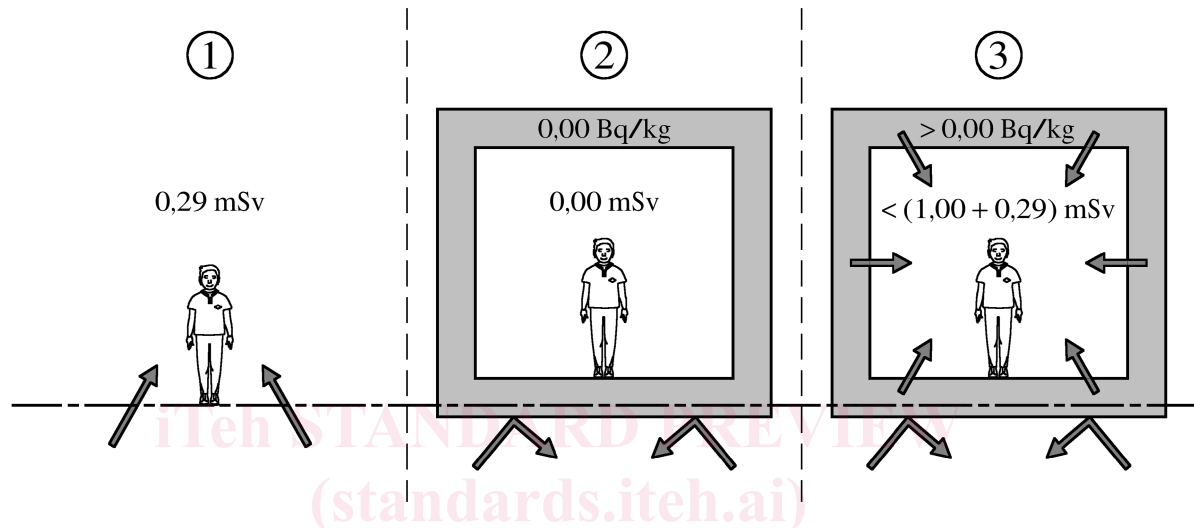
This document uses the symbols and names of quantities as mentioned below; the units in which the quantities shall be expressed are also given.

Symbol	Name of quantity	Unit
$A$	activity	Bq
$a$	massic activity of <sup>226</sup> Ra, <sup>232</sup> Th or <sup>40</sup> K	Bq/kg
$d$	thickness of the construction product	m
$\dot{E}$	normalised nuclide specific effective dose rate	mSv/h per Bq/kg
$E_{B1}$	annual effective dose from the building without subtraction of background	mSv per year
$E_{B2}$	annual effective dose from the building with subtraction of background	mSv per year
$E_{Bg}$	European annual average terrestrial background dose from gamma radiation	mSv per year
$E_{Cp}$	annual effective dose from the construction product	mSv per year
$i$	ordinal for the construction product(s) starting with $i = 1$ for the construction product located on the inside of the building structure	–
$j, k, l$	ordinals	–
$N$	number of construction products in the building structure	–
$\rho$	gross density of the construction product	kg/m <sup>3</sup>
$\rho_A$	mass per unit area	kg/m <sup>2</sup>
$\rho_{A1}$	combined mass per unit area of the construction product $i$ plus the construction products that are located in front of construction product $i$	kg/m <sup>2</sup>
$\rho_{A2}$	combined mass per unit area of the construction products that are located in front of the construction product $i$	kg/m <sup>2</sup>

## 5 Method for dose assessment

### 5.1 General

The dose assessment comprises two approaches to calculate the dose from a single construction product or an assembly of construction products. In addition, it calculates the dose of the building by summing the dose from each of the construction products that make up the building. Subsequently a subtraction of the dose from terrestrial background gamma radiation is applied to obtain the annual indoor effective dose from gamma radiation. The principle of the dose criteria and subtraction of the terrestrial background radiation in compliance with the EU-BSS [1] is illustrated in Figure 1.



#### Key

- 1 the average outdoor terrestrial effective dose in Europe (see 3.1)
- 2 the dose inside a building structure made of non-radiating materials (0,00 Bq/kg), where the structure also has a complete shielding effect on the terrestrial background radiation
- 3 the maximum acceptable annual indoor effective dose (1,00 mSv + 0,29 mSv) taking into account the dose contributions from the building materials with consideration of the average outdoor terrestrial background radiation dose (0,29 mSv)

**Figure 1 — Principle of the dose criteria and subtraction of the terrestrial background radiation in compliance with the Euratom Directive**

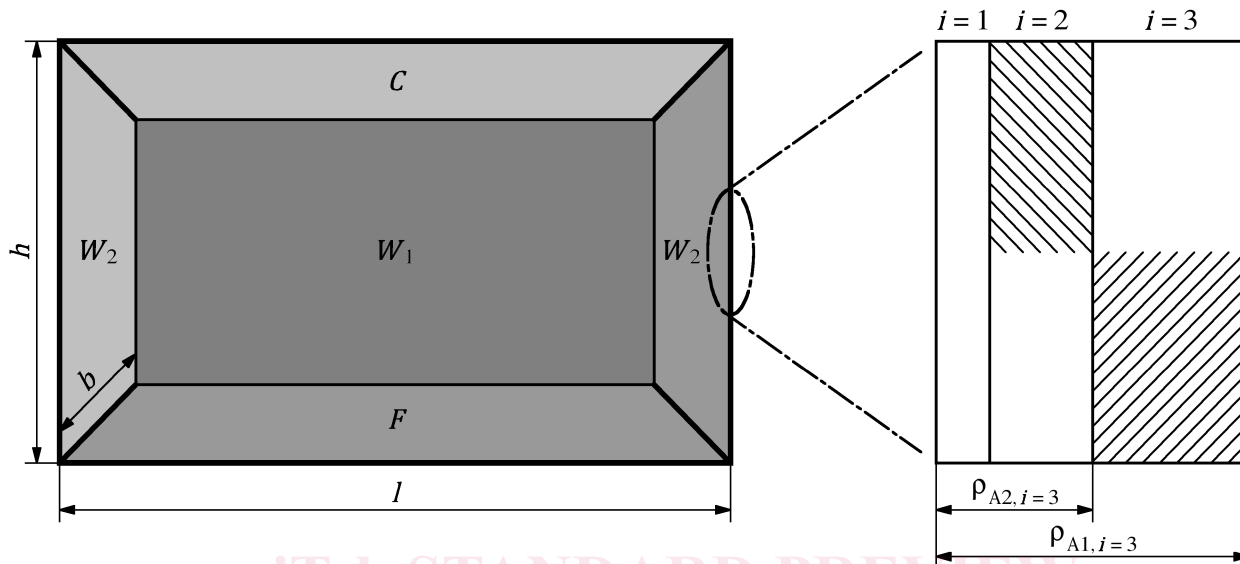
The method builds on a room geometry with a cuboid shape and six surfaces (see Figure 2), not including any doors or windows. Here the front and back wall ( $W_1$ ) have dimensions of 4 m  $\times$  2,5 m, the two side walls ( $W_2$ ) have dimensions of 3 m  $\times$  2,5 m, and the ceiling and floor ( $C$  and  $F$ ) have dimensions of 3 m  $\times$  4 m. The dose is determined for the centre of the room, which is called the dose point.

Calculation of the dose within the proposed procedure is based on the concept of mass per unit area  $\rho_A$ , which is the product's gross density multiplied with the product's thickness in its intended use. To determine the dose from each construction product applied either at all six surfaces or only one, shielding effects from the products located in front are considered. For this purpose, the parameters  $\rho_{A1}$  and  $\rho_{A2}$  are introduced.  $\rho_{A1}$  represents the mass per unit area of the construction product of interest together with all products located in front.  $\rho_{A2}$  represents the mass per unit area of all construction products located in front of the product that is considered and excludes the mass per unit area of the product itself. An example is shown in Figure 2. The difference between  $\rho_{A1}$  and  $\rho_{A2}$  is the mass per unit area of the considered construction product. For this reason, it is essential in the assessment to consider the appropriate order of the construction products, starting from the inside of the building structure. Where

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the assessment only considers one construction product,  $\rho_{A1}$  is the product's mass per unit area and  $\rho_{A2}$  is 0.

The dose assessment is designed for building structures with a mass per unit area of up to 500 kg/m<sup>2</sup>. Any part of the building structure located on the outside that exceeds 500 kg/m<sup>2</sup> will have a negligible effect on the dose and shall be ignored in the calculation.



## Key

<i>C</i>	ceiling	<i>b</i> = 3 m	<i>i</i> = 1	tiles / render / plaster
<i>F</i>	floor	<i>h</i> = 2,5 m	<i>i</i> = 2	concrete
<i>W<sub>1</sub></i>	wall <i>W<sub>1</sub></i>	<i>i</i> = ordinal	<i>i</i> = 3	facing brick / ceramic brick
<i>W<sub>2</sub></i>	wall <i>W<sub>2</sub></i>	<i>l</i> = 4 m		

NOTE The numbering (*i*) of the products runs from the inside to the outside of the building structure.

**Figure 2 — Sketch of the model room together with a building structure containing three construction products**

The main difference between both assessment approaches described under 5.2 and 5.3 is the following. The first assessment method for evaluation of a construction product is intended to assess the dose from an individual product and assumes its application on all six surfaces of the building. The second assessment method for evaluation of the building design is more refined and enables specifying multiple construction products for each of the building surfaces, which include the front and back wall, the two side walls, and the floor and ceiling separately.

Assessment of a single construction product does require that consideration shall be given to an intended use that is intrinsically combined with other bulk products. In that case the adjacent construction product shall be considered in the assessment in the form of a default material. For these circumstances, provisions are included to specify appropriate material properties for these additional materials. Typical scenarios include superficial materials or products intended for construction as an inner or outer wall.

For both assessment methods the calculated dose from the construction product considers the properties of the product itself and takes account of any self-attenuation in the product, but it also takes account of any shielding from the adjacent product(s) located on the inside of the product. It is therefore important to stress that the calculated dose of the construction product is not an intrinsic property of the product, but is specific to the composition of the building structure specified in the assessment.