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Construction products - Assessment of release of dangerous substances - Radiation from construction products - Dose assessment of emitted gamma radiation

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National foreword

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Produits de construction - Evaluation de l¿émission de substances dangereuses ¿ Détermination de l¿estimation dosimétrique et classification en fonction de l¿émission de rayonnement gamma

Bauprodukte - Bewertung der Freisetzung von gefährlichen Stoffen - Festlegung des Verfahrens zur Beurteilung der Strahlendosis und Klassifizierung von emittierter Gammastrahlung

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European foreword

This document (CEN/TR 17113:2017) 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.

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

Introduction

The aim of this report is to propose a dose assessment methodology that accounts for factors such as density or thickness of the material as well as factors relating to the type of construction and the intended use of the material (bulk or superficial) as required by Annex VIII of the 2013/59/EURATOM [1]. This approach is specially needed for building materials and construction products with an index exceeding 1 but that nonetheless may comply with the 1 mSv per year reference level established in the 2013/59/EURATOM [1].

NOTE Although the methodology is centred around the reference level of 1 mSv established in the 2013/59/EURATOM, the methodology is also applicable if a reference value other than 1 mSv per year is selected. In that case, the selected dose value *D* and its corresponding index value *I* is adjusted accordingly.

In 1996, natural radiation sources were already included in the standards established by Euratom as well as those established by the IAEA [2]. Since then, the European Commission has moved ahead publishing, on a regular basis, technical support guidance and recommendations on Naturally Occurring Radioactive Material (NORM) issues. In 1997, for instance, recommendations [3] were published to help deal with "significant increase in exposure due to natural radiations". In 1999, the European Commission published radiological protection principles concerning the natural radioactivity of building materials [4] and reference levels for workplaces processing materials with enhanced levels of naturally occurring radionuclides [5]. Lastly, in 2001 the European Commission published recommendations dealing with exemption and clearance levels for NORM residues [6].

These recommendations have provided Member States with criteria and a sound technical framework to help establish national regulations for NORM and building materials. Some Member States have already included all or parts of these recommendations in their regulatory framework anticipating the new EU directive.

Subsequently, the European Commission decided to harmonize, promote and consolidate the main recommendations, introducing them into a new Council directive (2013/59/Euratom [1]) laying down basic safety standards for the protection against the danger arising from exposure to ionising radiation. This BSS directive was officially issued in January 2014. Member States have four years to transpose and implement this directive and according to the Euratom treaty, these members will before then, communicate to the Commission their existing and draft provisions. The Commission will then make appropriate recommendations for harmonizing the provisions amongst member States.

Requirements of this directive (2013/59/EURATOM, [1]) dealing with building materials are hereby presented. They should be taken into account along with the 2011 EU regulation laying down harmonized conditions for the marketing of construction products (EU no 305/2011) [7], so called CPR, containing many relevant articles which complement the aforesaid directive.

Both EU regulatory documents constitute the new basis for building material radiation protection regulation and should be soon followed by more detailed EU guidance and standards of which this document (CEN/TR 17113) should be part.

The European Commission (EC) has mandated the CEN to establish EU harmonized standards regarding dose assessment of emitted gamma radiation from construction products. The EC has also informed CEN (CEN/TC 351, Berlin 11 February 2013) that the aim is to establish one test method per product, or product type, that the method should be demonstrably robust and should be adopted by all Member States as soon as the 2013/59/EURATOM comes into force.

This document can help Member State regulators to complete the 2013/59/EURATOM and CPR regulatory framework covering a screening tool, dose modelling, and related technical information about radiation protection. Amongst others, the following recommendations were discussed by the CEN and the EC for the content of this document:

— The scope will exclude radon and thoron exhalation from building materials because this exhalation is dealt with in a different manner in the EU regulation. Regulatory explanations are given in Clause 3.

— Main assumptions, coefficients and conversion factors are taken into account.

— The methodology enables establishing which building materials may lead to a dose exceeding 1 mSv per year for a member of the public or which building materials can be exempted from further restrictions.

— Mass per unit area (kg/m^2) of the material will be considered in the approach keeping a dose estimate model based on similar room models as the one used to establish the index mentioned in the 2013/59/EURATOM.

— Additional sensitivity analysis regarding the room geometry is presented in Annex E to demonstrate that there is no more than 10 % of influence of such geometry upon the determination of doses.

Lastly, it is important to underline that the EU regulatory philosophy is to ensure that gamma doses from building materials to a member of the public remain under 1 mSv per year in addition to outdoor external exposure (2013/59/EURATOM Article 75) [1]. A simplified model, so called "index" in the 2013/59/EURATOM is also proposed as a conservative screening tool ensuring that materials with an index *I* less than 1 do not present any risk exceeding 1 mSv per year of indoor gamma radiation, in any construction, to a member of the public.

Annex VIII of the 2013/59/EURATOM Directive presents such an index requiring determination of ^{226}Ra, ^{232}Th and ^{40}K. For the purposes of this determination, CEN/TC 351 has developed a test method to be published first as a Technical Specification (TS) and later after completed validation as a European Standard (EN). In certain cases, there is a need to assess dose more precisely as described in Annex VIII of the 2013/59/EURATOM Directive. This TR presents such a formula for more sophisticated calculation of dose. It could serve as basis for a European approach supporting the implementation of the 2013/59/EURATOM Directive taking place in member states, also from a harmonized approach point of view.

As determination of three radionuclides of gamma radiation according to an EN (TS) will be part of obligations of product manufacturers and will be referred to in harmonized product standards under the Construction Products Regulation (CPR; EU 305/2011) (hEN) it is proposed that assessment of dose could be consequently described in an EN.

This Technical Report presents the state-of-the-art on dose assessment presented in RP 112 [4] and now further developed into the form of a more sophisticated formula. It has been noticed that for credibility reasons exact correctness of all background data must be further checked. It is proposed that this could take place when developing a European Standard.

1 Scope

The aim of this Technical Report is to propose a methodology to determine indoor gamma dose from building materials and to help classify such a product as required in the Construction Products Regulation [7]. This first technical approach could be a precursor for the development of a harmonized European Standard based on this methodology.

NOTE 1 In this Technical Report, doses from radon and thoron exhalation are excluded. However, in 3.3, information is given on how radon exhalation is dealt with in (EU)2013/59/Euratom, the Basic Safety Standards Directive (2013/59/EURATOM) [1].

NOTE 2 Compliance with national exemption levels for NORM nuclides remains.

2 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16687 [8] and the following apply.

2.1
authorization
registration or licensing of a practice

[SOURCE: 2013/59/EURATOM, chapter II, Article 4, (7) [1]]

2.2
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]]

Note 1 to entry: Building materials considered in this Technical Report are the construction products used for building works. Other construction products used for any other construction works (civil engineering, etc.) are not relevant and out of the purpose of the scope of this Technical Report. The assessment described in this Technical Report was carried out under the assumption of the CEN/TC 351 model room.

2.3
competent authority
authority or system of authorities designated by Member States as having legal authority for the purposes of the 2013/59/EURATOM [1]

[SOURCE: 2013/59/EURATOM, chapter II, Article 4, (16) [1]]

2.4
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: It is defined by the expression:

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