

### Implementation of the EURATOM Basic Safety Standards Directive in member states

#### Relation with CEN/TS 17216 in CE-marking

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CEN/TC 351/WG 3  
 Construction products: Assessment of release of dangerous substances - Radiation

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### Natural Radioactivity

- U, Th, K: ubiquitous, primordial
- Uranium-238 decay chain (17 Radionuclides, Radium-226 as Reference)
- Thorium-232 decay chain (11 Radionuclides)
- Potassium-40
- Concentration in the range of some ppm (U, Th)
- Natural or technical enhanced concentrations

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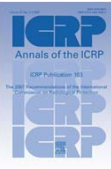
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### Long History

- Elster, Geitel: "Über die radioaktive Substanz, deren Emanation in der Bodenluft und in der Atmosphäre enthalten ist", Phys. Z. 5 (1904)
- 1950ies: Research in Sweden (R. Sievert)
- First regulations: 1971 UdSSR, 1972 UK
- 1999: Radiation Protection 112
- 2007: ICRP 103
- 2011: IAEA BSS (GRS-3)
- 2015: IAEA SSG-32




ICRP  
Annals of the ICRP

IAEA Safety Standards  
for protecting people and the environment

Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards


2011 (Rev. 2014) (GSR Part 3)




IAEA Safety Standards  
for protecting people and the environment

Protection of the Public against Exposure Indoors due to Radon and Other Natural Sources of Radiation

2011 (Rev. 2014) (SSG-32)



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### Common Aspects


## 1 millisievert (mSv)

Effective Dose per year  
 In addition of the natural Background

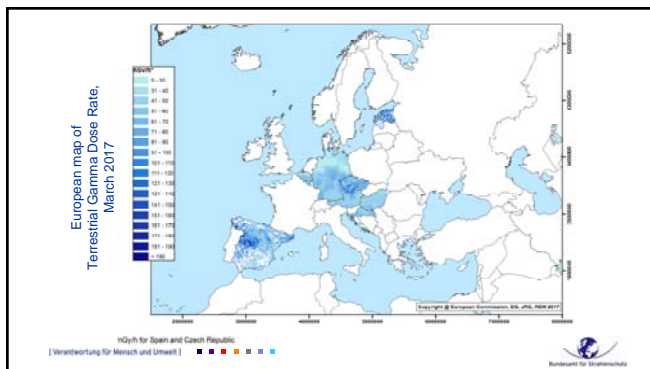
## Reference Value



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### Common Aspects



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**Common Aspects**

Article 75

**Gamma radiation from building materials**

1. The reference level applying to indoor external exposure to gamma radiation emitted by building materials, in addition to outdoor external exposure, shall be 1 mSv per year.




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**Common Aspects**

2. For building materials which are identified by the Member State as being of concern from a radiation protection point of view, taking into account the indicative list of materials set out in Annex XIII with regard to their emitted gamma radiation, Member States shall ensure that, before such materials are placed on the market:

- (a) the activity concentrations of the radionuclides specified in Annex VIII are determined, and that,
- (b) information to the competent authority on the results of measurements and the corresponding activity concentration index, as well as other relevant factors, as defined in Annex VIII, are provided if requested.

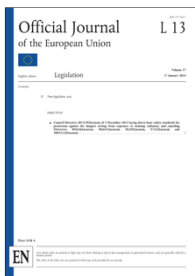


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**Common Aspects**

3. For types of building materials identified in accordance with paragraph 2 which are liable to give doses exceeding the reference level, Member States shall decide on appropriate measures, which may include specific requirements in relevant building codes or restrictions on the envisaged use of such materials.



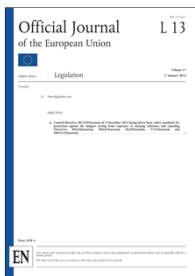
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ANNEX XIII **Common Aspects**

Indicative list of types of building materials considered with regard to their emitted gamma radiation as referred to in Article 75

1. Natural materials
  - (a) Aluminosilicates
  - (b) Building materials or additives of natural (geogenic) origin, such as:
    - granitoids (such as granite, gneiss and orthogneiss);
    - porphyries;
    - sulf;
    - peatlands (peatlands soils);
    - limestones.
2. Materials incorporating residues from industries processing naturally-occurring radioactive material, such as:
  - By ash:
    - phosphogypsum;
    - phosphorus slag;
    - tin slag;
    - copper slag;
  - and mud (residue from aluminium production);
  - residues from steel production



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**Common Aspects**

ANNEX VIII

Definition and use of the activity concentration index for the gamma radiation emitted by building materials as referred to in Article 75


For the purposes of Article 75(2), for identified types of building materials, the activity concentrations of primordial radionuclides Ra-226, Th-232 (or its decay product Ra-228) and K-40 shall be determined.

The activity concentration index I is given by the following formula:

$$I = C_{Ra-226}/300 \text{ Bq/kg} + C_{Th-232}/200 \text{ Bq/kg} + C_{K-40}/4000 \text{ Bq/kg}$$

where  $C_{Ra-226}$ ,  $C_{Th-232}$  and  $C_{K-40}$  are the activity concentrations in Bq/kg of the corresponding radionuclides in the building material.

The index relates to the gamma radiation dose, in excess of typical outdoor exposure, in a building constructed from a specified building material. The index applies to the building material, not to its constituents except where those constituents are building materials themselves and are separately assessed as such. For application of the index to such constituents, in particular residues from industries processing naturally-occurring radioactive material recycled into building materials, an appropriate partitioning factor needs to be applied. The activity concentration index value of 1 can be used as a conservative screening tool for identifying materials that may cause the reference level laid down in Article 75(1) to be exceeded. The calculation of dose needs to take into account other factors such as density, thickness of the material as well as factors relating to the type of building and the intended use of the material (bulk or superficial).

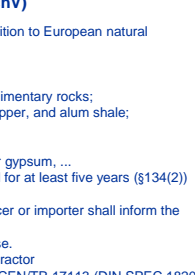


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**German Radiation Protection Law (StrlSchG) and the related ordinance (StrlSchV)**

- Reference value for an annual dose indoors of 1 mSv in addition to European natural background (§133 StrlSchG)
- Restricted to rooms used on a regular and repeatable way
- List of relevant natural materials
  - Acidic magmatic rocks and resulting metamorphic and sedimentary rocks;
  - Sedimentary rock with high organic content such as oil, copper, and alum shale;
  - Travertine
- List of NORM residues
  - slugs, scales, ashes ... from non-iron metallurgy, phosphor gypsum, ...
- The results of the measurements (Ra, Th, K) must be stored for at least five years (§134(2)) and must be shown to the authorities on request (§134(3)).
- If the effective dose exceeds the reference value, the producer or importer shall inform the authority without delay (§135(2)).
- Within one month the authority may restrict or prohibit the use.
- Information for the building owner, the architect and the contractor
- Density and thickness corrected index formula according to CEN/TR 17113 (DIN SPEC 18207)
- Fines are due for violations (StrlSchG §194(1) 1.b), 4, 33, and 34)



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### New Radiation Act 2018 in Finland

- Information for the building owner, the architect and the contractor
- Manufacturer/importer of construction product is obliged to define radiation exposure emerging from the product if the exposure may exceed the reference level
- The reference level for construction products is 1 mSv per year
  - Dose from Cs-137 may not exceed 0,1 mSv/year
- A (non-inclusive) list of materials, which may cause exposure in excess of reference level, is given:
  - Dose from Cs-137 may not exceed 0,1 mSv/year
  - The frame structure of the building which is made of mineral-based material
  - Construction products whose main component is granite or other granitoid-based gravel, sand or crushed stone
  - Construction products whose raw material is ash or side product/waste from industrial processes utilizing natural minerals
- Many materials (N in thousands) have been measured over the years and it is obvious that most materials do not cause exposure in excess of reference level

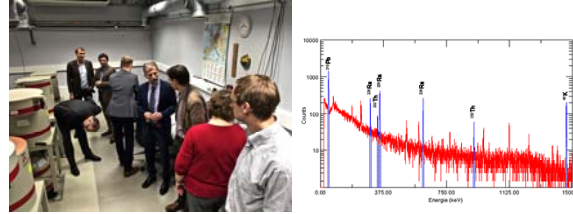
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### CEN/TS 17216

- Determination of the activity concentrations of Radium-226, Thorium-232 and Potassium-40 using gamma-ray spectrometry
- Based on NEN, ISO
- Measurements with HPGe-Detectors
- Preparation of samples and assessment specified



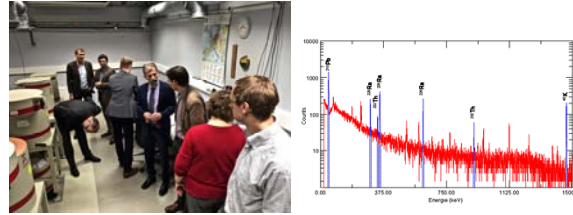
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### CEN/TS 17216

- Calibration with physical samples, no MC! • Specific grain size, homogeneity, humidity, ...
- Radon tightness of sample holders has to be proven • Specified energies for assessment!



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### The Similarities and Differences

- Ionizing Radiation part of Mandate M/366 → Link between EURATOM BSS Directive and EU CPR
- BSS Directive (2013/59/EURATOM) issued officially in January 2014
- EU Member States had 4 years time for implementation (- April 2018)
- Ionizing Radiation = the first pan-European "Dangerous Substance"
- Pan-European content: Ra, Th, K
- Pan-European reference value: 1 mSv per year (in addition to the background)

But:

- Legal basics → for some member states also IAEA-BSS
- What to measure? → National requirements → different lists of materials
- How to assess? → Not everywhere the same formula, background
- Competent authorities? → Radiation protection authorities or approval and assessment bodies
- When to start? → Implementation not finished everywhere.

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