ANVS
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Authority for Nuclear Safety and Radiation Protection

Regulation of Indoor Gamma Radiation from Building Materials

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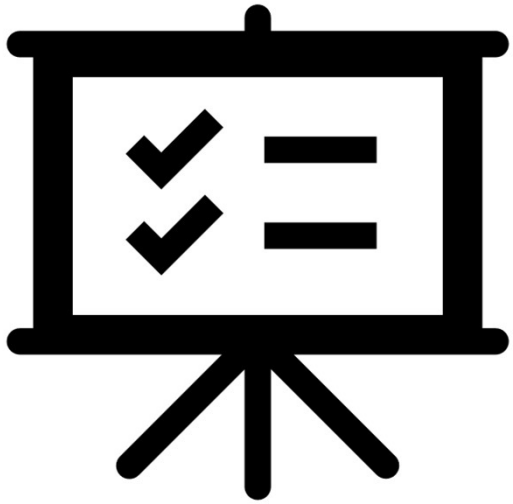
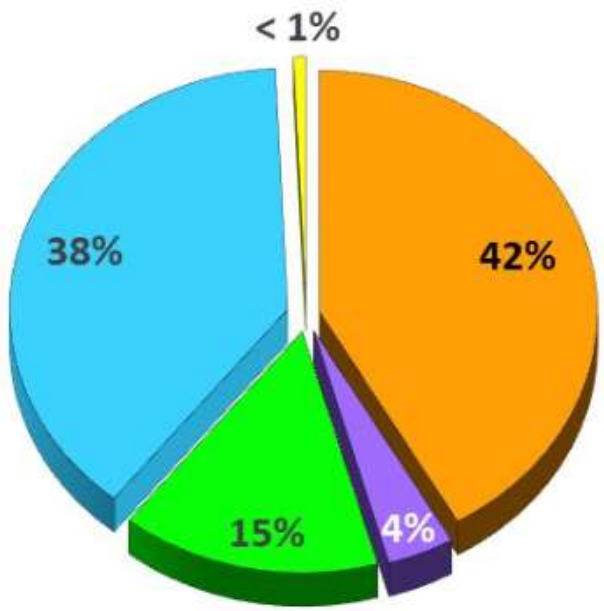
Content

- Indoor Exposure in the Netherlands
- Regulation of Building Materials in the Netherlands
- Natural Radioactivity in Typical Building Materials in the Netherlands
- Regulatory Challenges



Average Exposure in the Netherlands 2.8 mSv per year *



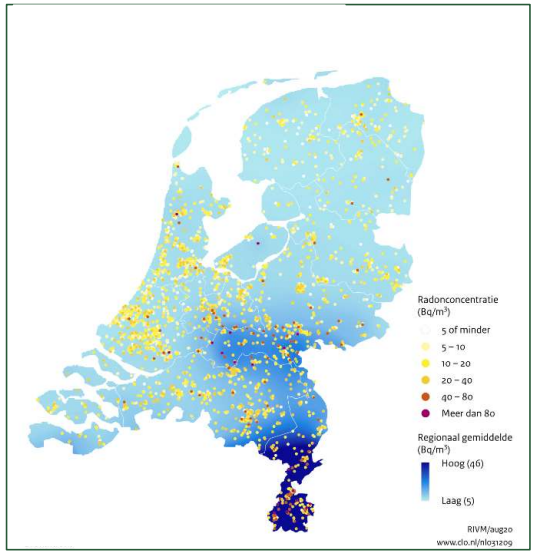
- Indoor exposure to natural radiation
- Outdoor exposure to natural radiation
- Natural radioactivity in the body
- Medical exposure (diagnostics)
- Industrial activities, etc.

* RIVM (National Institute of Public Health and the Environment)

Indoor Radon Exposure in the Netherlands

4th National Radon Survey *

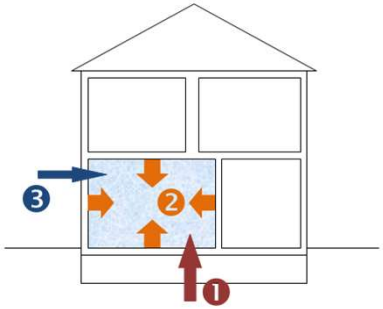
in dwellings (build 1930-2012)



National average: 16 Bq/m^3

Max. regional average: 40 Bq/m^3

0.4 % dwellings: 100 - 200 Bq/m^3



Indoor radon concentration is relatively low in the Netherlands

Nevertheless, 800 annual lung cancer cases attributed to indoor radon exposure

Building materials are a major source of radon in modern Dutch dwellings

* RIVM-2015

Indoor Exposure to Gamma-Radiation Emitted by Building Materials in the Netherlands

- Gross contribution to Effective dose
  0,34 mSv per annum

- Shielding provided by building materials against cosmic and terrestrial radiation
  - 0.27 mSv per annum

- The exposure to gamma-radiation emitted by building material in addition to outdoor exposure
  0,07 mSv per annum

Reviewed by RIVM-2021

De Jong, P. (Thesis, 2010)

Basic Safety Standards and Indoor Exposure in the Netherlands

- European BSS (2013/59/Euratom) were transposed in national legislation in 2018 and included the introduction of the *existing exposure situation*

- Indoor exposure to natural radiation receives special attention in the BSS
  - Indoor radon (reference level 100 Bq/m^3)

  - Gamma radiation emitted by building materials and requirements on the recycling of industrial NORM-residues
    - Identification of building materials
    - Methods to screen natural radioactivity in building materials and Activity Concentration Index (I)
    - Reference level of 1 mSv per annum
      - notification if exceeded

Types of Identified Building Materials Liable to Give Doses Exceeding the Reference Level *

- Natural materials
  - Alum-shale
  - Building materials or additives of natural igneous origin
    - Granitoids, tuff, etc.
    - *For NL, in addition to Euratom – Annex XIII: Zircon mineral sand*

- Materials incorporating residues from industries processing materials with natural radioactivity. Typical for the NL:
  - Fly ash
  - Phosphorus slag
  - Residues from steel production, etc.

* See also Euratom BSS - Annex XIII

Screening End Products (Building Materials)

Identify building materials

(i) natural materials
or
(ii) industrial residues containing NORM

Screening end-products with Activity Concentration Index (Euratom-BSS / EC-RP-112-publication)

$$I = C_{Ra}/300 + C_{Th}/200 + C_K/3{,}000$$

Index < 1?

Screening end-products with CEN/TC-351 Method or similar method

Dose calculation
(mass activity concentration, density and thickness)

Calculated Dose < 1 mSv

Interface between Euratom BSS and EU-CPR

- Euratom-BSS regulation of Building Materials
  - Criteria for Radiation Protection
    - Reference level of 1 mSv per annum

- Construction Products Regulation [Regulation (EU) 305/2011]
  - Harmonised assessment procedures through CE-marking
    - EN 17216 Measurement of radioactivity (Ra-226, Th-232, K-40)
    - EN 17637 Dose assessment of emmitted gamma-radiation

Discussion

- Harmonised European approach favours free trade within an internal market.
  - CPR provides harmonised radiological assessment procedure through CE-marking
  - Euratom sets basic safety standards that are transposed in national regulation, differences between Member States (MS) may, however, emerge
    - National Responsibility to decide on appropriate radiation protection measures
    - National Responsibility to identify building materials
  - Control on the import of building materials from third countries into the European Union

- Quality of measurements and information, sharing information
  - Representative sampling and uncertainty between samples
  - From screening projects to monitoring programmes
  - Exchange of information between MS

- Optimisation
  - Recycling, re-using residues from industrial procedures
  - Optimising exposure below reference level 1 mSv/y