



CEN/TC 351/WG 3
Radiation from construction products

CEN/TC 351 Conference
 Vilnius 16-17 October 2019
 Pekka Vuorinen
 CEN/TC 351/WG 3



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Who




Pekka Vuorinen
 – Director, Environment & Energy

- Finnish Association of Construction Product Industries RTT
- RTT is also a standards writing body nominated by Finnish Standards Association SFS
 - Responsible for 33 CEN TCs and 14 ISO TCs in Finland
 - CEN/TC 350 Sustainability of construction works
 - CEN/TC 351 Construction products - Assessment of release of dangerous substances
 - > **chairman of WG 3 “Radiation from construction products”**




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CEN/TC 351/WG 3
 “Radiation from construction products”

Why




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CEN/TC 351/WG 3 - background

- Ionizing radiation included in the EC Mandate M/366 (2005)
- CEN/TC 351 Workshop on Radiation from construction products October 2009 in Brussels
 - Recommendation 1
 - Develop (in CEN/TC 351) a standardised measurement method for activity concentrations of radioactivity (gamma radiation)
 - Recommendation 2
 - If it is necessary to develop a harmonised method for the calculation of the dose caused by gamma radiation, this should be covered in a separate standard.
 - Recommendation 4
 - Radon exhalation (noticed)
- CEN/TC 351/WG 3 'Radiation from construction products'; first meeting February 2011





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Linking (involved with) two EU regulatory frameworks

- Mandate M/366 issued by the European Commission in the framework of the “Construction Products Directive” 89/106/EEC.
- For the radiation from construction products reference is made to the EU BSS and its regulation of building materials.
 - > **BSS: basic safety standards for protection against the dangers arising from exposure to ionising radiation (Art. 54, 74 en 75)**

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An urgent need

- Ionizing radiation part of Mandate M/366 → a link to BSS Directive
- Basic Safety Standard Directive (2013/59/EURATOM) issued Jan 2014
 - > **EU Member states have had 4 years time to implement it into their national legislation – IT’S NOW!**
 - > new regulations in force e.g. in Finland, Germany, the Netherlands, Sweden
 - The Directive in its article 75 “Gamma radiation from building materials” addresses building materials (= construction products); sets a reference level “1 mSv per year.”
 - Annex VIII presents activity concentration index / asking determination of three radionuclides of gamma radiation as well as need to specify dose more precisely in certain cases
 - Reference also to radon exhalation from building materials (Annexes XVII and XVIII)
 - > **The implementation process is in full speed in MSS**
 - > **Ionizing radiation – the first pan-European “dangerous substance” addressed**



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Annex – Group photo of CEN/TC 351/WG 3, taken 9 September 2011 in Paris Le Vésinet by Jean-Louis Picolo



From left to right:
Karl-Heinz Ruck, Markus Peterson, Ugo Rassinio, Magnus Olsson, Patrick Vatsellas, Rosalynn Anshel, Gervet de Vries, Mike Taylor, Bernd Hoffmann, Annamaria Venemiano, Jeroen Ballefs, Christel Van Leerd, Franco-Josef Mangler, Florence Galley, Pekka Vuorinen, Raphael Bodek, Dieter Rosen.

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Standardization / current state




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Task groups of CEN/TC 351/WG 3

- TG 31: "Determination of Activity Concentrations"
 - TS 17216 "Determination of the activity concentrations of ²²⁶Ra, ²³²Th and ⁴⁰K using gamma-ray spectrometry"
 - Robustness validation (GIG, Katowice)
 - To do: Validation of repeatability and reproducibility - 2019-2020 (JRC, Geel)
 - To do: study on compliance test method → WI on EN
- TG 32: "Dose Assessment"
 - TR 17113 "Determination of dose assessment and classification for emitted gamma radiation".
 - To do: Development of EN on dose assessment – 2020-2021 (NRG, Arnhem)

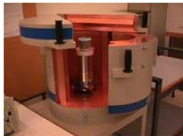




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CEN/TS 17216 / current state

- CEN/TS 17216 "Determination of activity concentrations of radium-226, thorium-232 and potassium-40 in construction products using gamma-ray spectrometry"
 - TS published in October 2018
 - 2nd validation step (collaborative trial; "Round robin") coordinated by JRC Geel; planning 2018-2019; will start 2020
 - publication as an EN 2022 (?)

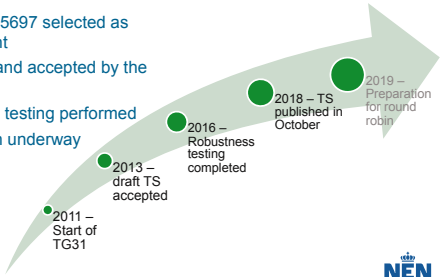




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Determination of natural radionuclides in BMs/CPs

- Inventory of existing standards carried out
- Dutch NEN 5697 selected as starting point
- TS drafted and accepted by the WG 3
- Robustness testing performed
- Round robin underway



- 2011 – Start of TG31
- 2013 – draft TS accepted
- 2016 – Robustness testing completed
- 2018 – TS published in October
- 2019 – Preparation for round robin




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Scope of CEN/TS 17216

- Based on NEN 5697
- Use of established high purity germanium detection technique
- Standard prescribes:
 - Sampling and sample treatment
 - Measurement using HPGE
 - Energy and efficiency calibration
 - Density correction and radon tightness
 - Background subtraction and spectrum analysis
 - Calculation of activity concentrations and its uncertainties
- Standard suitable for end-products and raw-materials





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Development of EN

- Coordination by JRC Geel
- Round robin to demonstrate repeatability and reproducibility
- Recommendations to improve the standard based on the outcome of the work
- EN standard scheduled for publication in 2022...

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Future work – e.g. compliance test methods

- Multiple requests for factory control methods
- Scintillation techniques and in-situ methods already in use
- Development of a secondary standard
- Request for standard enabling in-situ technology



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CEN/TR 17113 / current state

- CEN/TR 17113 Radiation from construction products — Dose assessment of emitted gamma radiation”
- Published in October 2017
- According to CEN/TC 351 Plenary 2017 (Vienna) Decision NWIP “EN Dose assessment”; accepted in April 2018
- Tender procedure to select consultant (rapporteur) Jan-Feb 2019
- > Rapporteur Govert de With, NRG (NL) chosen in April 2019
- 1 Oct 2019: 1st draft to WG 3 for comments
- Aim to publish an EN in autumn 2021



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CEN/TR 17113: Basic assumptions

Mika Markkanen
Radiation Dose Assessments for Materials with Elevated Natural Radioactivity
STUK-B-STO 32 NOVEMBER 1995

- RP 112 follows the philosophy that building materials shield all of the natural background. The total dose resulting from the building materials can be 1,29 mSv. Therefore the basic approach in determining the excess exposure is as follows:
 - The total exposure caused by the building is calculated
 - The exposure caused by terrestrial background gamma radiation is then subtracted from it
 - The result is referred to as the excess exposure
- 4.3.1 Shielding effect of materials for cosmic radiation
- 4.3.2 Conversion factor for absorbed dose in air
- 4.3.3 Occupancy
- 4.3.4 Activity concentrations for reference concrete in Europe
- 4.4 Graded approach to dose assessment taking into account density and thickness



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Dose assessment - steps

- BSS Article 75(2): “...radionuclides Ra-226, Th-232 (or its decay product Ra-228) and K-40 shall be determined.”
- BSS Annex VIII: “The activity concentration index I is given by the following formula:
 - $I = C_{Ra-226}/300 \text{ Bq/kg} + C_{Th-232}/200 \text{ Bq/kg} + C_{K-40}/3.000 \text{ Bq/kg}$
 - The activity concentration index value of 1 can be used as a conservative screening tool
 - 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).”

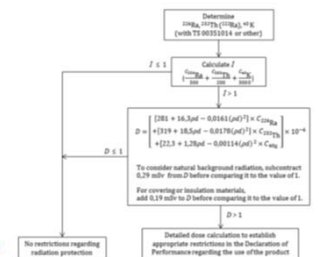


Figure 2 – Flowchart for Assessment of indoor gamma exposure due to building materials (construction products) used in their intended use as a final product in a permanent manner in a building or parts thereof



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Dose assessment - case

$$I = \frac{C_{Ra-226}}{300} + \frac{C_{Th-232}}{200} + \frac{C_{K-40}}{3000} \quad D = \left[\frac{[281 + 16.3pd - 0.0161(pd)^2] \cdot C_{Ra}}{300} + \frac{[319 + 18.5pd - 0.0178(pd)^2] \cdot C_{Th}}{200} + \frac{[22.3 + 1.28pd - 0.00114(pd)^2] \cdot C_K}{3000} \right] \cdot 10^{-6} - 0.29 \text{ mSv}$$



$I = 0.6 \quad D = 0.4 \text{ mSv}$



$I = 1.2 \quad D = 0.7 \text{ mSv}$

Source: Govert de With, NRG



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Draft EN Dose assessment

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Radon exhalation / current state

- Radon exhalation measurement method: postponed so far
 - Construction products addressed in the BSS Directive; future issue according to Radon action plan (Art. 103, Annex XVIII; also Art. 100 and Annex XVII)
 - The next possible step: proposal for a NWIP to develop an EN or something else
 - > TR to discuss problems on measurement (uncertainties, robustness)?
 - > ISO/TC 82 has in 2016 published ISO 11665-9 'Measurement of radioactivity in the environment — Air: Radon-222 — Part 9: Test methods for exhalation rate of building materials'
 - > Using emission test chamber established in EN 16516 also discussed



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CEN/TC 351/WG 3 and stakeholders Communication / co-operation




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HERCA Workshops on NORM & BM

- HERCA workshops in 2014, 2015 and 2016 for exchanging on new requirements relating to radon, NORM and building materials of the Council Directive 2013/59/Euratom (BSSD).
 - Bergen 24-25 May 2016: CEN/TC 351/WG 3 invited
 - > CEN: "Assessing Ionizing Radiation from Construction Products under Construction Product Regulation CPR"
 - > The Netherlands: "A simplified Dutch approach for the implementation of the EU BSS Directive for building materials"
- HERCA WG on Natural radiation sources
 - Meetings September 2018 (Paris) and September 2019 (Oslo); CEN/TC 351/WG 3 invited
 - Oslo meeting conclusions: continue co-operation, link the work of WG 3 also to Euratom art. 31 GoE WPNAT
 - > Development of guidelines on Radioactivity in Building Materials



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Other events

- COST Action "NORM4Building" Symposium in Rome, June 2017
 - Govert de With (NRG, NL): "A harmonised European norm for the determination of natural radioactivity in construction products"
 - Pekka Vuorinen (CEN): "Assessing ionizing radiation from construction products under Construction Product Regulation CPR — Dose assessment of emitted gamma radiation"
 - Symposium working group on "standardized assessment of construction products": a strong support for development of European harmonized measurement and assessment tools (standards)
- EU NORM Symposium (NPL, Teddington, UK 2-5 October 2017
 - Govert de With (NRG, NL): "A harmonised European norm for the determination of natural radioactivity in construction products"
 - Pekka Vuorinen (CEN): "Assessing Ionizing Radiation from Construction Products under CPR - Dose assessment of emitted gamma radiation"
- European Norm Association Workshop 19-23 2018 November (Katowice, Poland)
 - WG 3 work presented by Bernd Hoffmann (Bfs, Germany)
 - Invitation to the 19th EAN WORKSHOP "INNOVATIVE ALARA TOOLS" to be held in Athens November 2019



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New radiation act 2018 in Finland

- 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:
 - 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 form industrial processes utilizing natural minerals
- A large number of materials (N in thousands) has 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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STUK regulation on natural radioactivity

- Same indices as in 1992 are given and they are used as screening tools at the lab
- If the index value of 1 is exceeded (about 30 % of samples), the results are sent to STUK's inspectors and STUK orders the responsible party to make more precise estimations on radiation exposure caused by the product
- Manufactures/importers are responsible for measurements and product safety; STUK does not take random samples/impose measurements


Dose assessment to the public not required if:

- 1) Building construction

$$C_{Ra}/200 + C_{Th}/300 + C_{K}/3000 \leq 1;$$
- 2) Construction of roads, streets and yards/playgrounds

$$C_{Ra}/500 + C_{Th}/700 + C_{K}/8000 + C_{Cs}/2000 \leq 1;$$
- 3) Land construction other than in index 2) e.g. filling, landscaping

$$C_{Ra}/1500 + C_{Th}/2000 + C_{K}/20000 + C_{Cs}/5000 \leq 1;$$



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Thank you for your attention!

More information and contact

www.centc351.org

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