

A Simple Dose Assessment Tool for Construction Products (CEN TC351 WG3 TG32)

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**EU-NORM 2
Prague, June 17 – 19, 2014**

Background EU-BSS

- ▶ 1 mSv per year (in add. to nat. background)
- ▶ national list of materials
 - ▶ natural materials (alum-shales, igneous rock)
 - ▶ residues from NORM-Practices
- ▶ activity index I, notification, ...

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Legislation

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Contents

II Non-legislative acts

DIRECTIVES

★ Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom 1

Price: EUR 4

EN

Acts whose titles are printed in light type are those relating to day-to-day management of agricultural matters, and are generally valid for a limited period.

The titles of all other acts are printed in bold type and preceded by an asterisk.



Tento dokument je třeba brát jako dokumentační nástroj a instituce nenesou jakoukoli odpovědnost za jeho obsah

- ▶ **Harmonised conditions for the marketing of construction products**
- ▶ **basic requirements: no threat or high impact due to**
 - ▶ **emission of dangerous substances**
 - ▶ **emission of dangerous radiation**
- ▶ **CE Marking**
- ▶ **CEN: Mandate for harmonised standards (M/366 DG ENTR)**

► **B** **NAŘÍZENÍ EVROPSKÉHO PARLAMENTU A RADY (EU) č. 305/2011**
ze dne 9. března 2011,
kterým se stanoví harmonizované podmínky pro uvádění stavebních výrobků na trh a kterým se zrušuje směrnice Rady 89/106/EHS
(Text s významem pro EHP)
(Úř. věst. L 88, 4.4.2011, s. 5)

PŘÍLOHA I

ZÁKLADNÍ POŽADAVKY NA STAVBY

3. Hygiena, ochrana zdraví a životního prostředí

Stavba musí být navržena a provedena takovým způsobem, aby v průběhu celého životního cyklu neohrožovala hygienu nebo bezpečnost a zdraví pracovníků, jejich uživatelů nebo sousedů, ani neměla v celém průběhu životního cyklu nepřiměřeně významný vliv na kvalitu životního prostředí nebo na klima, a to během výstavby, používání i demolice, zejména následkem:

- a) uvolňování toxických plynů;
- b) emisí nebezpečných látek, těkavých organických sloučenin, skleníkových plynů nebo nebezpečných částic do vnitřního nebo venkovního ovzduší;
- c) emisí nebezpečného záření;

CEN

- ▶ **TC 351: "Construction Products: Assessment of Release of Dangerous Substances"**

- ▶ **WG 3: "Radiation from Construction Products"**

- ▶ **TG 31: "Determination of Activity Concentrations"**
 - **Draft TS 351014 "Determination of the activity concentrations of ^{226}Ra , ^{232}Th and ^{40}K using gamma-ray spectrometry"**
 - **Robustness validation (Bogusław Michalik, Śląskie Centrum Radiometrii Środowiskowej, Katowice)**

- ▶ **TG 32: "Dose Modelling"**
 - **TR "Determination of dose assessment and classification for emitted gamma radiation"**

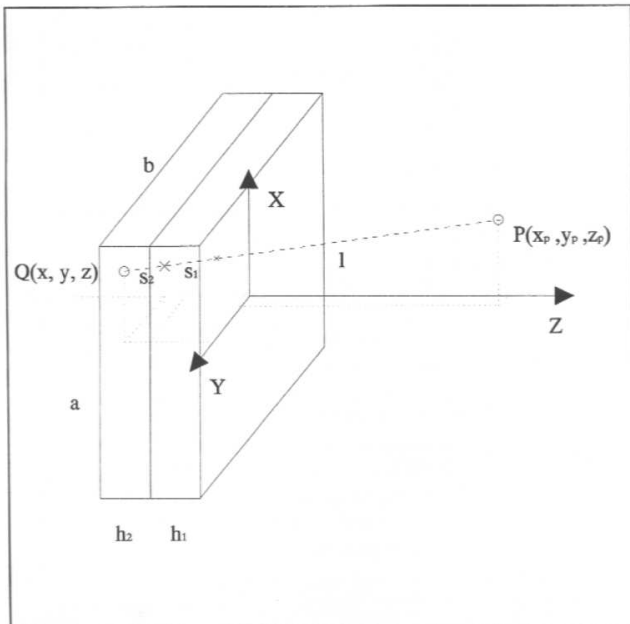
CEN TC351 WG3

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- Marta Garcia-Talavera AENOR CSN
- ...



Specifications for a dose assessment

- ▶ Second step of a graded approach!
- ▶ Be compatible to RP 112 and EU-BSS!
- ▶ But use the standard room of WG2 (Emission in indoor air)!
- ▶ But without windows and doors!
- ▶ Consider the individual thickness (d) and density (ρ)!
- ▶ It would be nice to have the mass per unit area ($\rho \cdot d$) as parameter!
- ▶ And the result should be the annual dose and not an index!
- ▶ Keep it simple!



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

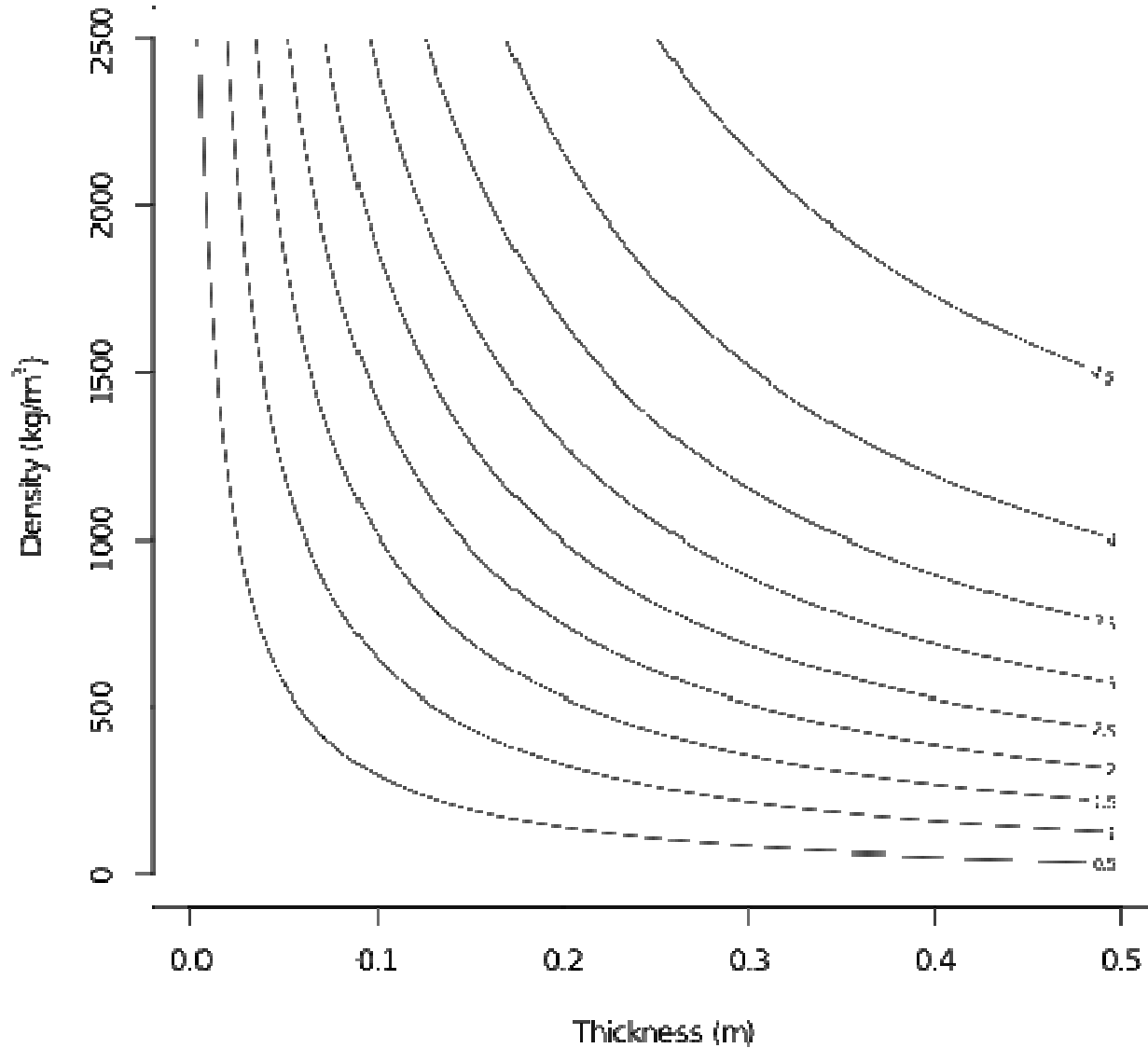
$$D_1 = 5.77 \cdot 10^{-7} \frac{C_1 \rho_1}{4\pi} \sum \gamma_i \left(\frac{\mu_{en}}{\rho} \right)_i E_i \int B_i(1) \frac{e^{-\mu_i(1)s_1}}{l^2} dV$$

$$B_i(1) = 1 + C(E_i) \mu_i(1) s_1 e^{D(E_i) \mu_i(1) s_1}$$

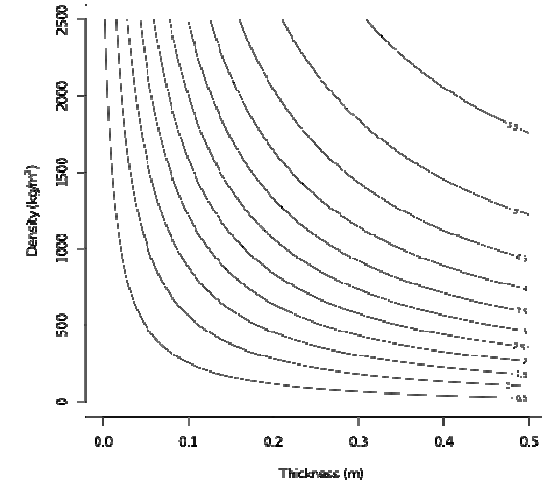
$$s_1 = \left| \frac{z}{z_p - z} \right| l \quad l = \sqrt{(x_p - x)^2 + (y_p - y)^2 + (z_p - z)^2}$$

Let's do some number crunching!

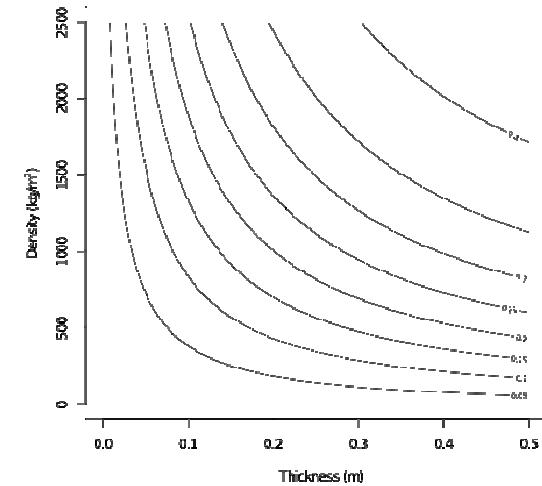
Annual Dose, μSv per Bq/kg, Ra



Annual Dose, μSv per Bq/kg, Th



Annual Dose, μSv per Bq/kg, K



Let's do some maths!

$D = f(\text{total activity, room dimension, all the rest})$

$= f(C_{Ra}, C_{Th}, C_K, m, \dots)$, with $m = \rho d A$

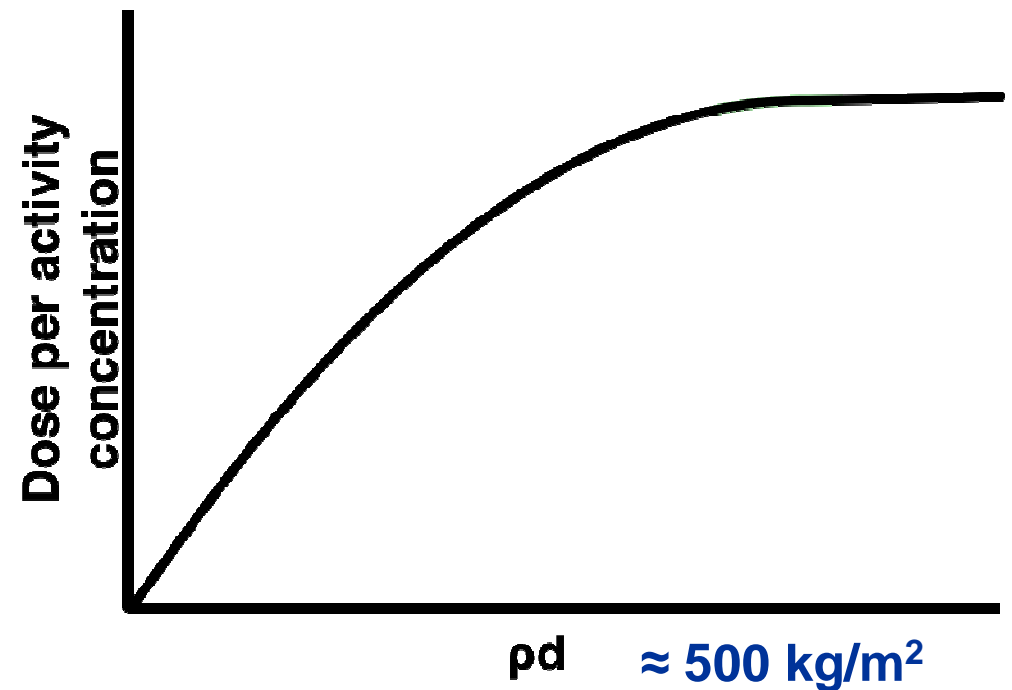
$= f_1(\rho d, \dots)C_{Ra} + f_2(\rho d, \dots)C_{Th} + f_3(\rho d, \dots)C_K$

f_i is smooth \rightarrow Polynomial expansion

$f_i = a_0 + a_1(\rho d) + a_2(\rho d)^2 + a_3(\rho d)^3 + \dots$

fit $\rightarrow a_i$

For $\rho d < 500 \text{ kg/m}^2$: 2nd order



Proposal

$$D = \left[\begin{array}{l} [281 + 16.3\rho d - 0.0161(\rho d)^2] \cdot C_{Ra} \\ + [319 + 18.5\rho d - 0.0178(\rho d)^2] \cdot C_{Th} \\ + [22.3 + 1.28\rho d - 0.00114(\rho d)^2] \cdot C_K \end{array} \right] \cdot 10^{-6} - 0.29 \text{ mSv}$$

for $\rho d < 500 \text{ kg/m}^2$

$\triangleq 60 \text{ nSv/h}$

**\approx surface area weighted
average of all 23 countries**

(7000 h, 0.7 Sv/Gy)

Some examples

$$C_{Ra} = 50 \text{ Bq/kg}$$

$$C_{Th} = 50 \text{ Bq/kg}$$

$$C_K = 500 \text{ Bq/kg}$$

$$\rho = 2350 \text{ kg/m}^3$$

$$d = 0.2 \text{ m}$$

$$I = 0.6$$

$$D = 0.4 \text{ mSv}$$

$$C_{Ra} = 110 \text{ Bq/kg}$$

$$C_{Th} = 90 \text{ Bq/kg}$$

$$C_K = 1000 \text{ Bq/kg}$$

$$\rho = 800 \text{ kg/m}^3$$

$$d = 0.32 \text{ m}$$

$$I = 1.2$$

$$D = 0.7 \text{ mSv}$$

Děkuji

