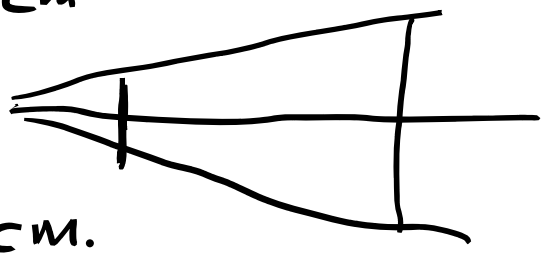
3) $\dot{D} = \Gamma \frac{A}{r^2} = 0{,}305 \frac{75 \cdot 10^3}{5^2}\ \mu Gy/h = 0{,}915\ mGy/h$

b) Terugverstrooiing 180° aan beton voor ^{60}Co is:

0,0125 % op 1m per $100\ cm^2$



Bundel op 1m → 15 cm

Dus op 7m → 7 · 15 = 105 cm.

Opp op 7m: $\pi R^2 = \frac{1}{4}\pi D^2 = \frac{1}{4}\pi (1{,}05 \cdot 10^2\ cm)^2 = 8{,}67 \cdot 10^3\ cm^2$

$\dot{D}_{muur} = \left(\frac{5}{7}\right)^2 0{,}915\ mGy/h = 0{,}467\ mGy/h.$

$\dot{D}_{1m} = 0{,}0125\ \% \cdot \frac{8{,}67 \cdot 10^3}{100} \cdot 0{,}467\ mGy/h = 5{,}05\ \mu Gy/h.$

$\dot{D}_p = \dot{D}_{2m} = \left(\frac{1}{2}\right)^2 \dot{D}_{1m} = 1{,}26\ \mu Gy/h.$

$$\frac{D(r_1)}{D(r_2)} = \left(\frac{r_2}{r_1}\right)^2$$

$$\frac{D(1)}{D(2)} = \left(\frac{2}{1}\right)^2 = 4$$

c) Std afstand vanaf de bron is R

$$\dot{D}_1^P = \Gamma \frac{A}{R^2} = 0{,}305 \cdot \frac{75 \cdot 10^3}{R^2}\ \mu Gy\,m^2/h = \frac{22{,}9}{R^2}\ mGy\,m^2/h$$

$$\dot{D}_2(1m) = 5{,}05\ \mu Gy/h$$

$$\dot{D}_2^P = \left(\frac{1}{7-R}\right)^2 \dot{D}_2(1m) = \frac{5{,}05 \cdot 10^{-3}}{(7-R)^2}\ mGy\,m^2/h$$

$$\frac{\dot{D}_2^P}{\dot{D}_1^P} \text{ eis } \leq 0{,}01 = \frac{5{,}05\ 10^{-3}}{(7-R)^2} \cdot \frac{R^2}{22{,}9}$$

$$ax^2 + bx + c = 0 \Rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$5{,}05\ 10^{-3} R^2 = 0{,}01 \cdot (7-R)^2\ 22{,}9$$

$$= 0{,}229\,(49 - 14R + R^2) = 11{,}221 - 3{,}206R + 0{,}229R^2$$

$$(a+b)^2 = (a+b)(a+b) = a^2 + ab + ab + b^2 = a^2 + 2ab + b^2$$

$$0{,}224R^2 - 3{,}206R + 11{,}221 = 0$$

$$R = \frac{3{,}206 \pm \sqrt{(3{,}206)^2 - 4 \cdot 0{,}224 \cdot 11{,}221}}{2 \cdot 0{,}224} = \frac{3{,}206 \pm 0{,}472}{0{,}448}$$

$= \cancel{8{,}21\ m}$ kan niet

$= 6{,}10\ m$

Beter!

opp = $8{,}67 \cdot 10^3\ cm^2$

bij $100\ cm^2$ 0,0125% verstrooiing op 1m

dus $8{,}67 \cdot 10^3 / 100 \cdot 0{,}0125\% = 1{,}083\%$ op 1m.

Op afstand x van muur:

$\left(\frac{x}{1}\right)^2 \cdot 1{,}083\% \overset{!}{=} 1\% \Rightarrow x = 0{,}92\ m \Rightarrow R = 6{,}08\ m$

34) $A = 1{,}5 \cdot 10^{12}$ Bq $= 1{,}5$ TBq.

wand 10 cm lood

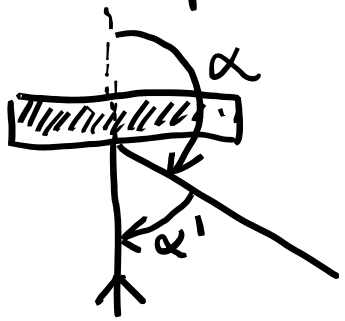
opp. opening 100 cm^2

a) $\dot{D} = \Gamma \frac{A}{r^2} T$

$T = T_{\text{10 cm lood}} \cdot T_{\text{50 cm beton}} = 4 \cdot 10^{-3} \cdot 8 \cdot 10^{-3} = 3{,}2 \cdot 10^{-5}$

$\dot{D} = 0{,}305 \cdot \frac{1{,}5\,10^6}{2{,}5^2} \cdot 3{,}2 \cdot 10^{-5} = 2{,}4$ μGy/h

b) $\dot{D} = \Gamma \frac{A}{r^2} = 0{,}305 \frac{1{,}5 \cdot 10^6}{4{,}0^2} = 29{,}1$ mGy/h



$\tan\alpha' = \frac{2{,}5}{4{,}0} \Rightarrow \alpha' = 32° \Rightarrow \alpha = 180 - 32 = 148°$

Figuur → 0,012 % scattering op 1m per 100 cm^2

Opening $100\ cm^2$ op $50\ cm$, dus op $4\ m$ is het oppervlak

$$\left(\frac{4,0}{0,5}\right)^2 \cdot 100\ cm^2 = 6,4 \cdot 10^3\ cm^2$$

Dosistempo op $1\ m$: $\frac{6,4 \cdot 10^3}{100} \cdot 0,012\ \% \cdot 29,1\ mGy/h = 0,22\ mGy/h$

$$\dot{D}_E = \left(\frac{1}{\sqrt{2,5^2+4,0^2}}\right)^2 \cdot 922 = 9,9\ \mu Gy/h \gg \dot{D}_{direct}$$

35] a) SA = 2,1 m.

Lekstraling: op 1 m: 2 mGy/h

op 2,1 m: $(1/2{,}1)^2 \cdot 2$ mGy/h = 0,45 mGy/h

$\hat{=}$ 0,45 mGy/h · 20 h/wk = 9,1 mGy/wk

$\hat{=}$ 9,1 mSv/wk.

Transmissie: $\frac{0{,}02}{9{,}1} = 2{,}2 \cdot 10^{-3} \rightarrow$ 65 cm beton. (fig 33)

Strooistraling: op 1m: 100 Gy/h

op 0,6m: $(1/0{,}6)^2 \cdot 100$ Gy/h = $2{,}8 \cdot 10^2$ Gy/h.

$\hat{=}$ $2{,}8 \cdot 10^2$ Gy/h · 20 · $\frac{1}{4}$ h/wk = $1{,}4 \cdot 10^3$ Gy/wk.

Fig 44 → 0,002 % op 1m per 100 cm² bij 90°

$\Rightarrow$ 0,002 % · $1{,}4 \cdot 10^3$ Gy/wk op 1m per 100 cm²

= $2{,}8 \cdot 10^{-2}$ Gy/wk " " " "

$\hat{=}$ $2{,}8 \cdot 10^{-2}$ · $(1/2)^2$

= $6{,}9 \cdot 10^{-3}$ Gy/wk op 2m per 100 cm²

$\hat{=}$ $6{,}9 \cdot 10^{-3}$ $\left(\frac{400}{100}\right)$

= 28 mGy/wk op 2m per 20×20 cm²

Transmissie $\frac{0,02}{28} = 7,1 \cdot 10^{-4}$

Fig 38 $\xrightarrow{\phi = 90°}$ $d = 42$ cm beton.

$\therefore$ Bijdrage strooistraling $\ll$ lekstraling $\Rightarrow$ 65 cm beton is genoeg.

b) Re dosis in B:

dosis op 1m: 100 Gy/h

5m: $(1/5)^2 \cdot 100$ Gy/h $= 4$ Gy/h.

$\hat{=} 4$ Gy/h $\cdot$ 20 h/wk $\cdot \frac{1}{4} = 20$ Gy/wk.

Transmissie: $\frac{0,02 \cdot 10^{-3}}{20} = 1,0 \cdot 10^{-6}$

Fig 33 $\rightarrow$ $d = 130$ cm beton.

Omdat lekstraling $\ll$ primaire bundel $\Rightarrow$ 130 cm beton rondom voldoende is.

c) $AID = ID \cdot \underset{\substack{\uparrow \\ 0,01}}{ABC}$

afstand tot parkeerterrein: $5 + 10 = 15$ m.

Dosistempo: $(5/15)^2 \cdot 0,02 = 0,002$ mSv/uur.

$\hat{=} 0,002$ mSv/uur $\cdot$ 50 uur/jr $= 0,11$ mSv/jr.

$AID = 0,11$ mSv/jr $\quad 0,01 = 1,1$ mSv/jr.