Conversion of Exposure Rate constant to Air Kerma Rate Constant

Let's consider Ir^{192}

→ Exposure rate constant of Ir^{192} is

$$\Gamma_\delta = 4.69 \ R\,cm^2\,h^{-1}\,mCi^{-1}$$

We know that $1R = 2.58 \times 10^{-4}\ C\,kg^{-1}$

Thus,

$$4.69\ R\text{-}cm^2/mCi\,h \times 2.58 \times 10^{-4}\ C\,kg^{-1}/R$$

$$= 1.21002 \times 10^{-3}\ C\,kg^{-1}\,cm^2/mCi\,h$$

The average energy W required to produce ion pair in air is

$$= 33.85\ eV$$

Exposure to dose conversion factor for air is $= 33.85 \times 1.6 \times 10^{-19}\ J$

the Charge of $e^- = 1.6 \times 10^{-19}\ C$

So $$(\bar{W}/e)_{air} = \frac{33.85 \times 1.6 \times 10^{-19}\ J}{1.6 \times 10^{-19}\ C}$$

$$= 33.85\ J\,C^{-1}$$

Therefore

$$1.21 \times 10^{-3}\ C\,kg^{-1}\,cm^2/mCi\,h \times 33.85\ J\,C^{-1}$$

$= 0.04096 \ J \ kg^{-1} \ cm^2 / mCi \ h$

$$1 \ Gy = 1 \ J / kg$$

So

$0.04096 \ Gy \ cm^2 / mCi \ h$

$1 \ Ci = 3.7 \times 10^{10} \ Bq$

Thus Air Kerma Rate constant

$$= \frac{40960 \ \mu Gy \ cm^2 / mCi \ h}{37 \ MBq}$$

$$\Gamma_{AK} = 1107.02 \ \mu Gy \ MBq^{-1} h^{-1} cm^2$$