(21.12) Ru, Rh, and Pd are recovered from the waste from a 10 GWe program. What will the annual amounts and specific radioactivities be at t_{cool} = 10 y for each of them?

$Bq := sec^{-1}$ $GBq := 10^{9} \cdot Bq$ $TBq := 10^{12} \cdot Bq$

$P_{tot} := \frac{10 \cdot 10^{9}}{0.34} \cdot watt$ $t_{irr} := 1 \cdot yr$ $BUP := 33 \cdot 10^{6} \cdot watt \cdot day \cdot kg^{-1}$

$Q_{tot} := P_{tot} \cdot t_{irr}$ $m_{tot} := \frac{Q_{tot}}{BUP}$ $m_{tot} = 3.255 \cdot 10^{5} \cdot kg$ fuel.

Use data from Table 21.2 for amounts and radioactivity. First recalculate amounts:

$m_{Ru} := 2.18 \cdot gm \cdot kg^{-1}$ $m_{totRu} := m_{tot} \cdot m_{Ru}$ $m_{totRu} = 710 \cdot kg$

$m_{Rh} := 0.47 \cdot gm \cdot kg^{-1}$ $m_{totRh} := m_{tot} \cdot m_{Rh}$ $m_{totRh} = 153 \cdot kg$

$m_{Pd} := 1.37 \cdot gm \cdot kg^{-1}$ $m_{totPd} := m_{tot} \cdot m_{Pd}$ $m_{totPd} = 446 \cdot kg$

Specific activities of spent fuel from Table 21.2 and 1 metric ton of IHM:

$R_{Ru} := 22.2 \cdot \frac{TBq}{1000 \cdot kg}$ $R_{Rh} := 22.1 \cdot \frac{TBq}{1000 \cdot kg}$ $R_{Pd} := 0.004 \cdot \frac{TBq}{1000 \cdot kg}$

Then compute specific activities of our elements:

$S_{Ru} := \frac{R_{Ru}}{m_{Ru}}$ $S_{Ru} = 10.2 \cdot \frac{TBq}{kg}$

$S_{Rh} := \frac{R_{Rh}}{m_{Rh}}$ $S_{Rh} = 47 \cdot \frac{TBq}{kg}$

$S_{Pd} := \frac{R_{Pd}}{m_{Pd}}$ $S_{Pd} = 2.92 \cdot \frac{GBq}{kg}$