

Air Dosimetry Report

Ionizing Activity of Radon Daughter Isotopes

Filter #: 289
Station #: 724 Kearney, NE
Sampled Days : 2012 10 29 → 2012 11 02

α Data

$$\mathcal{A}_1 = 14638 \text{ pCi} \quad \lambda_1 = 1.335 \text{ hr}^{-1} \quad \mathcal{A}_2 = 3552.7 \text{ pCi} \quad \lambda_2 = 0.074058 \text{ hr}^{-1}$$

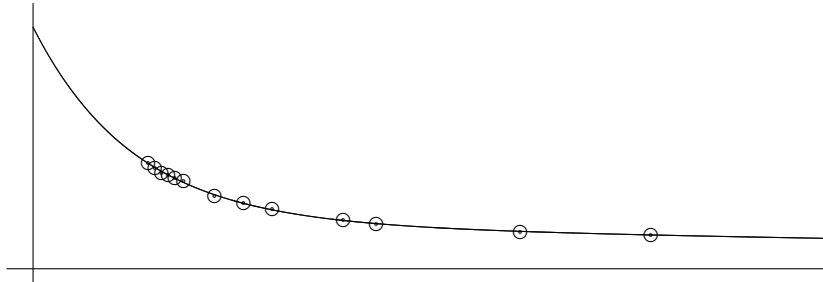


Figure 1: α Activity versus Time

$$\mathcal{R} = \lambda \mathcal{A}_{\text{stop}} / (1 - e^{-\lambda t_{\text{stop}}}) \Rightarrow \mathcal{R}_1 = 19541.7300 \frac{\text{pCi}}{\text{hr}} @ \tau_1 = 0.75 \text{ hr} , \text{ and } , \mathcal{R}_2 = 263.3284 \frac{\text{pCi}}{\text{hr}} @ \tau_2 = 13.50 \text{ hr}$$

$$\alpha - \text{exposure} \approx \mathcal{R} \times 95.55 \text{ hr} / 5728.0 \text{ m}^3 = 325.9798 \text{ pCi/m}^3 , \text{ and } , 4.3926 \text{ pCi/m}^3 .$$

β Data

$$\mathcal{A}_1 = 88041 \text{ pCi} \quad \lambda_1 = 1.4224 \text{ hr}^{-1} \quad \mathcal{A}_2 = 21135 \text{ pCi} \quad \lambda_2 = 0.073583 \text{ hr}^{-1}$$

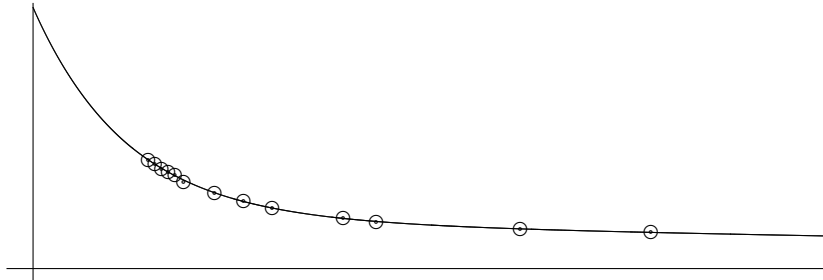


Figure 2: β Activity versus Time

$$\mathcal{R} = \lambda \mathcal{A}_{\text{stop}} / (1 - e^{-\lambda t_{\text{stop}}}) \Rightarrow \mathcal{R}_1 = 125229.5184 \frac{\text{pCi}}{\text{hr}} @ \tau_1 = 0.70 \text{ hr} , \text{ and } , \mathcal{R}_2 = 1556.5530 \frac{\text{pCi}}{\text{hr}} @ \tau_2 = 13.59 \text{ hr}$$

$$\beta - \text{exposure} \approx \mathcal{R} \times 95.55 \text{ hr} / 5728.0 \text{ m}^3 = 2088.9805 \text{ pCi/m}^3 , \text{ and } , 25.9652 \text{ pCi/m}^3 .$$

Filter #: 289
Station #: 724 Kearney, NE
Sampled Days : 2012 10 29 → 2012 11 02

The total from all four components is 2445.3181 pCi/m³. This may be conveniently compared to the EPA standard for Radon in your home. Remediation is recommended if tests show your home contains 4000 pCi/m³ or more. The amount measured for this sample is **61.1%** of the EPA's benchmark for Radon in your home.

Respiration rate $\approx 12 \rightarrow 20$ breaths per minute = $(6.3 \times 10^6 \rightarrow 10.5 \times 10^6)$ breaths per year.

Lung tidal volume ≈ 0.0005 m³/breath.

Therefore, our exposure while this sample was being collected was equivalent to $(7.7028 \rightarrow 12.8379)\mu\text{Ci}/\text{yr}$.

Friday morning, 02 Nov 2012, KLM returned from the roof with a "Hot" filter in hand.

A few minutes later JB informed RIP that the detector was emitting a steady tone when they tried to detect the filter's activity. He noted that the detector recorded 82,168 alpha/beta events per minute at the seven minute mark as the detector "alert" was sounding.

Using the model values:

Alpha Activity:

$$\mathcal{A}_1 = 14638 \text{ pCi} \quad \lambda_1 = 1.335 \text{ hr}^{-1} \quad \mathcal{A}_2 = 3552.7 \text{ pCi} \quad \lambda_2 = 0.074058 \text{ hr}^{-1}$$

The total alpha activity at $t = 7$ minutes was 16048.94

The detector's alpha efficiency is 1.66. Therefore, according to the model, the alpha count at $t = 7$ minutes was 9668

Beta Activity:

$$\mathcal{A}_1 = 88041 \text{ pCi} \quad \lambda_1 = 1.4224 \text{ hr}^{-1} \quad \mathcal{A}_2 = 21135 \text{ pCi} \quad \lambda_2 = 0.073583 \text{ hr}^{-1}$$

The total beta activity at $t = 7$ minutes was 95533.11

The detector's beta efficiency is 1.15. Therefore, according to the model, the beta count at $t = 7$ minutes was 83072

The clean filter count was 524, therefore the total count, according to the model, at $t = 7$ minutes was 112106

Note: The value from the model is larger than the value measured by KLM and JB.
