Air Dosimetry Report

Ionizing Activity of Radon Daughter Isotopes

This report is intended to inform you of the "background radiation" in the vicinity of Kearney Nebraska.

Just as drinking water may reasonably contain radiological contaminants, dust carried in the air also contains natural radiological materials. The *Annual Water Quality Report* provided by the City of Kearney reports these values in picoCuries per liter. This report lists airborne radiological contaminants in picoCuries per cubic meter and compares the measured activity to the EPA's benchmark for Radon in your home.

We captured dust from 12 Mar 2014 to 15 Mar 2014 in the EPA RadNet monitoring station located atop UNK's Bruner Hall of Science. Analysis shows that during that time dust particles carrying two types of radiation emitters produced exposure in the following amounts:

$$\alpha \text{ - exposure} \approx 52.05 \text{ pCi/m}^3$$
$$\beta \text{ - exposure} \approx 286.66 \text{ pCi/m}^3$$

The overall exposure rate for this time span was, $\mathscr{E} = 338.7161$ pCi/m^3.
Comparing this sample to the EPA standard for Radon in your home, our exposure as about 8.5% of the EPA's benchmark for Radon in your home. The EPA recommends remediation if tests show your home contains 4000 pCi/m^3 or more.

If you approximate your respiration rate to be $12 \rightarrow 20$ breaths per minute, and your tidal volume (the amount of air you inhale each breath) to be about 0.0005 m^3/breath, then the results quoted in this report suggest an exposure in the range of $(1.0670 \rightarrow 1.7783)\mu$Ci/yr.
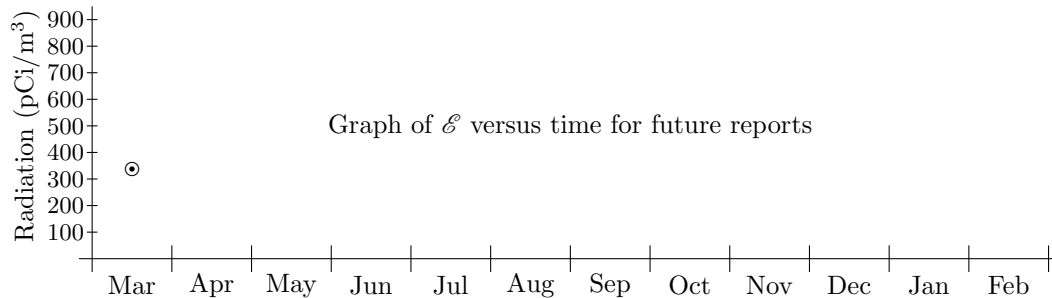
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Report Identification:

Filter #: __336__
Station #: __724__ Kearney, NE
Sampled Days : __2014 03 12 $\rightarrow$ 2014 03 15__

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α Data

$\mathcal{A}_1 = 2841.2$ pCi $\qquad \lambda_1 = 1.0923$ hr^{-1} $\qquad \mathcal{A}_2 = 380.42$ pCi $\qquad \lambda_2 = 0.041647$ hr^{-1}
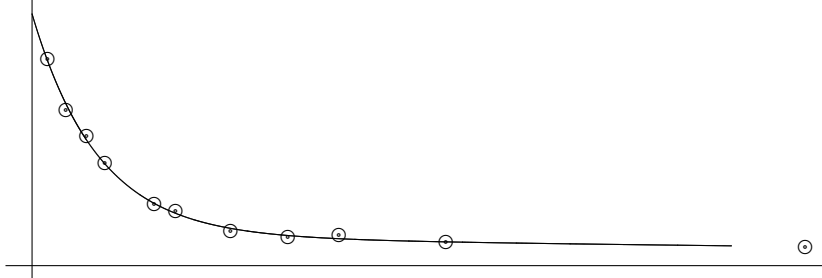

Figure 1: α Activity versus Time

$$\mathcal{R} = \lambda \mathcal{A}_{\text{stop}} / \left(1 - e^{-\lambda t_{\text{stop}}}\right) \Rightarrow \mathcal{R}_1 = 3103.4428 \, \frac{\text{pCi}}{\text{hr}} @ \, \tau_1 = 0.92 \text{ hr} \text{ , and , } \mathcal{R}_2 = 16.6468 \, \frac{\text{pCi}}{\text{hr}} @ \, \tau_2 = 24.01 \text{ hr}$$

α - exposure $\approx \mathcal{R} \times 72.78$ hr$/4362.4$ m$^3 = 51.7762$ pCi/m^3, and , 0.2777 pCi/m^3.

β Data

$\mathcal{A}_1 = 2562.3$ pCi $\qquad \lambda_1 = 0.038055$ hr^{-1} $\qquad \mathcal{A}_2 = 16332$ pCi $\qquad \lambda_2 = 1.0457$ hr^{-1}
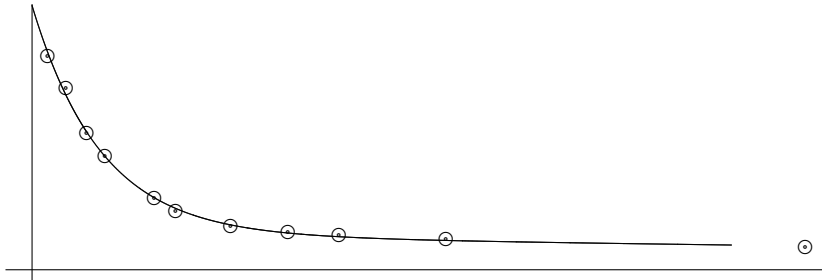

Figure 2: β Activity versus Time

$$\mathcal{R} = \lambda \mathcal{A}_{\text{stop}} / \left(1 - e^{-\lambda t_{\text{stop}}}\right) \Rightarrow \mathcal{R}_1 = 104.0293 \, \frac{\text{pCi}}{\text{hr}} @ \, \tau_1 = 26.28 \text{ hr} \text{ , and , } \mathcal{R}_2 = 17078.3724 \, \frac{\text{pCi}}{\text{hr}} @ \, \tau_2 = 0.96 \text{ hr}$$

β - exposure $\approx \mathcal{R} \times 72.78$ hr$/4362.4$ m$^3 = 1.7356$ pCi/m^3, and , 284.9266 pCi/m^3.