Journal of Environmental Radioactivity
Volume 102, Issue 1, January 2011, Pages 60-63

doi:10.1016/j.jenvrad.2010.09.004 | How to Cite or Link Using DOI

Temperature calibration formula for activated charcoal radon collectors

Alexandre Cooper[a], **Thiem Ngoc Le**[b], **Takeshi Iimoto**[a] **and Toshiso Kosako**[a]

[a] Graduate School of Engineering, The University of Tokyo, 2-11-16 Yayoi, Bunkyo-ku, Tokyo 113-0032, Japan

[b] Institute of Nuclear Science and Technology, Vietnam Atomic Energy Commission, 59 Ly Thuong Kiet, Hanoi, Viet Nam

Received 2 November 2009; revised 15 September 2010; accepted 16 September 2010.
Available online 9 October 2010.

Abstract

Radon adsorption by activated charcoal collectors such as PicoRad radon detectors is known to be largely affected by temperature and relative humidity. Quantitative models are, however, still needed for accurate radon estimation in a variable environment. Here we introduce a temperature calibration formula based on the gas adsorption theory to evaluate the radon concentration in air from the average temperature, collection time, and liquid scintillation count rate. On the basis of calibration experiments done by using the 25 m^3 radon chamber available at the National Institute of Radiological Sciences in Japan, we found that the radon adsorption efficiency may vary up to a factor of two for temperatures typical of indoor conditions. We expect our results to be useful for establishing standardized protocols for optimized radon assessment in dwellings and workplaces.

Research highlights

► The temperature effect on radon adsorption is proportional to $\alpha e^{\beta/T}$. ► The calibration formula is $CF(T,t) = 3.1 \times 10^{-5} e^{\frac{2887}{T-255}}[1 - e^{-0.080t}]$. ► The radon adsorption efficiency varies up to a factor of two for T = 8.5–31 °C. ► The average temperature is suitable for estimating CF(T,t) in a fluctuating environment.

Keywords: Radon gas; PicoRad detectors; Activated charcoal collectors; Calibration experiment; Conversion factor; Temperature effect

Article Outline

1. Introduction

Radon (^{222}Rn) is an ubiquitous and pervasive naturally occurring radioactive gas that is responsible for about half of human exposure to natural radiation sources (UNSCEAR, 2000). PicoRad detectors are simple commercially available activated charcoal radon