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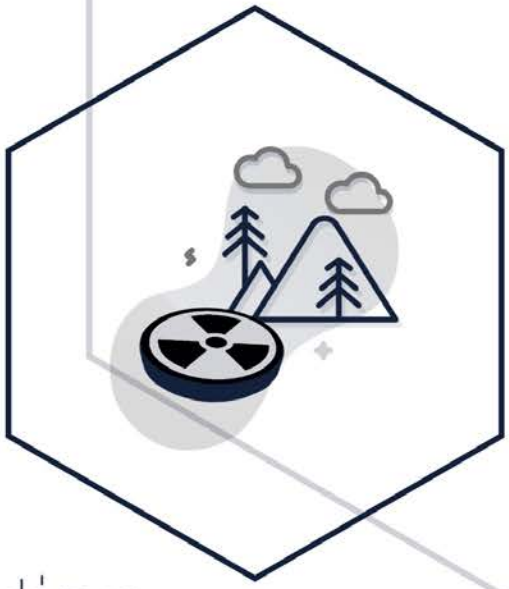

HANDBOOK OF EXPERIMENTS

SG6155E Environmental Radioactivity Outdoor

Radiological evaluation of the building materials

Environmental radioactivity

EDUCATIONAL KIT

SP5640

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Radiological evaluation of the building materials

Categories: CAEN Experiments, Environmental radioactivity | Tags: Gamma detection, Gamma rays, Nuclear Physics, γ Spectroscopy

Difficult	Execution Time	Data Analysis	Radioactive Sources
		Yes	No

Hardware setup

This experiment guide is referred to the **SP5640** educational kit.

Equipment: SP5640 – Backpack Detector

Model	**SP5640**
Description	Backpack Detector

Purpose of the experiment

The main goal of the experiment is the estimation of the natural radioactivity content in several dwellings and/or buildings representative of the different geological construction materials and commonly used in building constructions.

Fundamentals

The main contributors on the overall natural indoor effective dose to which population is exposed are ^{222}Rn and ^{220}Rn isotopes of radon gas, by-products of the ^{238}U and ^{232}Th series.

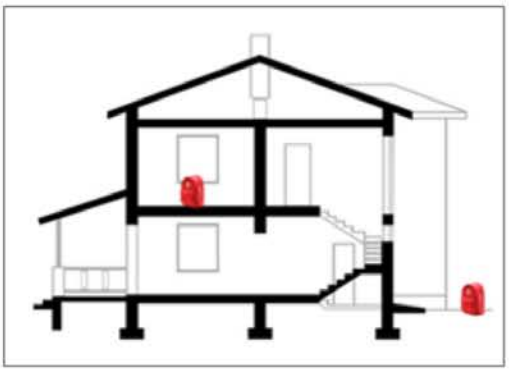
Only a fraction of radon atoms preserves enough kinetic energy to leave the grain of the material where it has been generated and to reach the empty space in the porous materials (emanation process that depends on the material itself). Moreover, only a fraction of the radon atoms reaching the pore volume of the material mass can escape into the air and reaches the spaces where people live (exhalation process). The exhalation rate and the emanation coefficient.

The study of the natural radionuclides ^{232}Th, ^{40}K, ^{226}Ra, and the radon emanation coefficient exhalation rate is essential to estimate the actual risk for human health associated to a given natural material used for building construction. The natural radioactivity content of building materials depends on the local geology of each region on Earth. One of the requirements of estimate the radiation hazards in closed spaces, aiming to better protect against natural ionizing radiations exposure, is the assessment of the radiation hazards arising from the use of natural building materials in the construction of dwellings, since the majority of people in the World spend most time in indoor environments.

Requirements

No other tool is needed.

Carrying out the experiment



Experimental setup block diagram

- Power on the γ-stream inside the red backpack.
- Power on the tablet and associate the two devices via Bluetooth.
- Take care that the γ-stream internal battery is charged, otherwise use the external power system.
- Start the measurement campaign and place the backpack on the floor far from the room walls.
- Set the acquisition time to about 5 minutes and see the results. If the statistic is not enough increasing the acquisition time.
- Repeat the measurements in a different place where the building material is different and compare the results.

Results

The measurement results are compared to the reference values in the terrestrial crust. The discrepancy in the reference levels can be explained by the building material, distance from soil and more. This kind of measurement is important for the evaluation of natural radiation exposure from building materials [2013/59/Euratom Directive and by UNSCEAR (United Nations Scientific Committee on the Effects of Atomic Radiation)].

Isotopic abundances evaluated in buildings located in different places and made with several construction materials:

	^{238}eU [ppm]	^{232}Th [ppm]	^{40}K [%]
Reference Values Range	*[2 ; 2.5]*	*[8 ; 12]*	*[2 ; 2.5]*
Tuff Dwelling (4° floor)	10±1	31±1	6.9±02
Modern Building (1° floor)	2.8±0.6	8.8±1.1	1.6±0.1
Country House (0° floor)	6.8±0.9	17.6±1.6	3.4±0.2

Isotopic abundances evaluated in buildings located in different places and made with several construction materials.

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