

Alpha Spectrometry Hardware - Airborne Alphas

The time for big instruments such as the Model 770 Continuous Particulate Air Monitor for supervision of Radon and Thoron concentration in air seems to be over. However, we will discuss this unit as it demonstrates the working principle of these monitors quite well. In the picture below



one sees the white filter tape which is moved from the supply roll (right) to the take-up roll. A controlled flow of air is sucked by an external pump via the golden funnel and through the tape where all dust particles and aerosols are deposited together with the adhering atoms of radon progeny.

A semiconductor detector sitting inside the funnel at about 3 mm over the tape measures the alpha spectrum from the deposition spot. After ten minutes the tape is advanced by the width of the

deposition spot, the next measurement begins and the last spectrum is analyzed. After several hours the measured spot on tape will reach the location in front of the golden block on the left side of the tape duct. There is another semiconductor detector which measures a spectrum, but nevertheless after several hours of decay time. From the analysis of the first spectrum one gets the activity of ^{222}Rn (Radon) daughters, whereas the second measurement yields the ^{220}Rn (Thoron) daughters activity. These measurements are NOT made in vacuum but in open air at low source-to-detector distance, instead.

Photo: alphaNUCLEAR



The same principle of measuring spectra from deposited progeny is applied in the continuous working level monitor PRISM 595 which is designed for personal monitoring in mines, caves, waterworks and other locations where Rn-dosimetry is an issue. The sturdy 8"x8"x2" unit contains batteries for 8 hours of operation, pump and electronics and it can be carried by a handle.

Photo: DURRIDGE Co. Inc.



The RAD-7 spectrometer and pump serves the same purpose, and it is also equipped with a printer for immediate documentation.

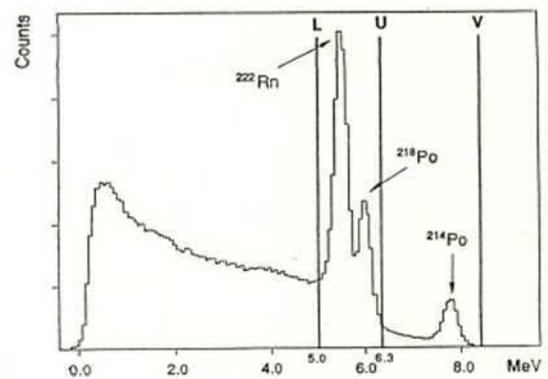
A completely different measuring principle is applied in the portable AlphaGuard spectrometer shown below. The unit pumps a controlled flow of air through a measuring volume where the air is used as the counting gas in a pulsed ionization chamber.



Photo: SAPHYMO

The resulting spectrum is analyzed by defining specific regions of interest. One ROI, L to U in the spectrum below, yields the absolute value of the ^{222}Rn concentration in the air.

A spectrum with some comments is shown below.



The 256-channel spectrum from a pulsed ionization chamber shows the peaks from ^{222}Rn and its daughters ^{218}Po and ^{214}Po . Only the ^{222}Rn peak can be quantified, the other nuclides may be irreproducibly lost to the chamber walls. The spectrum is very difficult to analyse when there is also ^{220}Rn (Thoron) present in the air.