



## Radon equilibrium factor variations in pumped well water

Heiko Woith (1) and Henning von Philipsborn (2)

(1) Deutsches GeoForschungsZentrum GFZ, Potsdam, Germany (heiko.woith@gfz-potsdam.de), (2) Radiometric Seminar, Faculty of Physics, University of Regensburg, Germany (henning.philipsborn@ur.de)

Preliminary results about radon and radon progeny at radon wells (Geophysical Research Abstracts, Vol. 19, EGU2017-4535, 2017) revealed that the variation of the equilibrium factor  $k$  between radon and its decay products requires a lengthy discussion and reveals valuable information. We performed new systematic measurements to understand the temporal variations of  $k$  at two wells in Bavaria. Sibyllenbad, in the community of Neualbenreuth, 140 km NNE of Regensburg, currently collects radon-rich water from two wells. The water is used pure or mixed with  $\text{CO}_2$ -rich water for therapy in 200 L bathtubs for a number of indications. For the special local operating conditions, high time resolution monitoring of the radon concentration measurements is asked. To this end, radon concentration is monitored continuously at the main water storage tank of 42 m<sup>3</sup>, two km from the radon wells. The probe at the tank consists of a 51 mm x 76 mm NaI (Tl) scintillator with photomultiplier, immersed in continuously flowing water in an 8 L pot. A multi-channel analyser registers the pulses between 200 and 650 keV of the Rn decay products Pb-214 and Bi-214. At the Rn wells, the flow rate [L/s] of the discontinuously working pumps and the lowering of the water level in [m] is measured online. Furthermore, we repeatedly took discrete water samples, both at the well head and at the water tank. The following measurements were performed: (i) direct radon measurements using a degassing unit and a ZnS(Ag) scintillation counter, (ii) radon progeny collected on special filters, and (iii) radon progeny determined immediately after sampling and after 3 hours (to allow equilibration between radon and its decay products). This data set allows to examine temporal variations of radon, and radon progeny as a function of the flow rate and the water table. Factors of equilibrium  $k$  between Rn and the decay products as low as 0.5 were determined. This explains strong, but systematic fluctuations in gamma recordings. The true Rn-222 concentration fluctuates much less.