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Remote online monitoring of radon wells used for therapy in bathtubs

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Sibyllenbad, in the community of Neualbenreuth, 140 km NNE of Regensburg, is well known for two radon wells and one containing carbon dioxide. The water is used pure or mixed for therapy in 200 L bathtubs for a number of indications. Since its beginning, 26 years ago, the author is active in measuring radon and radon decay products and their factor of equilibrium in air and in water for radiation protection of the personnel and for radon water quality assurance for the patients. For the special local operating conditions - high time resolution of measurements is asked - novel measuring methods and instruments were developed. These proved to be useful for several other applications, not foreseen at the beginning.

Recently, a probe was installed for online monitoring of water entering the main water storage tank of 42 m3, at the Kurhaus, two km from the radon wells. The probe consists of a 51 mm x 76 mm NaI (Tl) scintillator with photomultiplier, immersed in continuously flowing water in an 8 L pot. The MCA registers the pulses between 200 and 650 keV of the Rn decay products Pb-214 and Bi-214. Specially developed software calculates the gross [cps] from the total counts for variable counting times. The background, determined separately, is subtracted and the net is multiplied with a calibration factor [Bq/L per net cps], determined separately. The activity concentration [Bq/L] of the radon decay products in water is plotted vs. real time (plot P). With Teamviewer, remote online monitoring is possible from the Radiometric Seminar.

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. The two quantities are directly correlated, and with a time lag to the demand of radon water from the Kurhaus. Several series of discrete measurements of water, both at the well and at the storage tank, fresh and after 1, 2 and 3 h after storage in full, closed bottles, reveal factors of equilibrium k between Rn and the decay products as low as 0.5. This explains strong, but systematic fluctuations in the continuous plot P following demand of water for the patients. The true Rn-222 concentration fluctuates much less and is not lowered at the well after heavy rain falls. The variation of k requires a lengthy discussion and reveals valuable information.