THE SIMULTANEOUS MEASUREMENT OF TRITIUM ACTIVITY AND THE BACKGROUND COUNT RATE IN A PROPORTIONAL COUNTER BY POVINEC METHOD; THREE YEAR EXPERIENCE AT RUDER BOŠKOVIĆ INSTITUTE

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The concentration of tritium in water samples has been measured at Ruder Bošković Institute by proportional counter filled with methane obtained by reaction of water with aluminium carbide. The energy interval for tritium measurement was set between 1 and 10 keV to obtain the best figure of merit. Following the method suggested by P.Povinec the pulses in the energy interval above maximal tritium energy (18 keV) were measured at the same time. A very good correlation between background count rate in measured interval and the interval above 20 keV was observed. By this method background variations due to various meteorological conditions can be registered in the same time when measurements of active samples were performed. By using of the correlation coefficient between counts in both intervals the activities of samples can be calculated taking into account small variations of background values.

The measurement of tritium activity requires very pure gases and therefore a careful purification is required. The quality of counting gas has been controlled by measuring the resolution of $^{55}$Fe spectrum in the proportional counter. A good resolution indicates very pure counting gas, whereas the broadening of the $^{55}$Fe spectrum is due to gas impurities. In addition, impure gases show a shift of pulse amplitudes towards the lower part of spectrum resulting in the increase of counts in the measured interval (1 - 10 keV) and the decrease in the interval above 20 keV. A very good correlation between counts in the upper interval and the resolution of $^{55}$Fe spectrum was observed, enabling the gas quality control during the measurement.

The contamination of groundwater samples with Radon is very frequent and may result in a error in measured tritium activity in spite of a large difference in energy spectra. A constant monitoring of the energy interval above 20 keV reveals immediately the Radon contamination. A 15 day period of gas sample storage is routinely applied to allow the decay of Radon.