

Radon Concentration Calculation For the CRM-510LP

Although the built-in computer normally performs all the computations and provides the radon concentration data in pCi/l or Bq/m³, it is advisable for the operator to know how to carry out "hand" calculations. A back-up "hand" calculation should be carried out after entering a new calibration factor or background value to verify their correct entry.

To perform a "hand" calculation, record the number of counts accumulated and the elapsed time shown on the LCD display, convert to counts per minute, and apply the conversion factor (C.F.) and background (BKG) values supplied with the instrument to obtain the radon level in units of pCi/l. The following formula is used for this conversion:

Radon Conc. in pCi/l = (Ending Count – Beginning Count) / [Elapsed Time (in minutes) x C.F.] – BKG(in pCi/l)

Rewritten :

$$\text{pCi/l} = \frac{(\text{Ending Count} - \text{Beginning Count})}{[\text{Elapsed Time (in minutes)} \times \text{C.F.}]} - \text{BKG}$$

The background subtraction is generally only necessary for radon levels below 10 pCi/l. Background of the Model CRM-510LP has been determined from aged air measurements to be in the range of 0.075 to 0.30 counts per minute. This corresponds to 0.25 to 1 pCi/l for a unit with a nominal 0.3 CPM/pCi/l calibration factor. The background does not vary significantly with time nor from unit to unit, because the pulsed ion counter detector and open grid chamber in the CRM-510LP discriminates against all ionizing radiation other than airborne alpha.

As a sample calculation:

$$\text{pCi/l} = \frac{(3150 - 0)}{[2880 \text{ minutes} \times .357 \text{ cpm/pCi/l}]} - 0.5 \text{ pCi/l}$$

$$\text{pCi/l} = \frac{3150/2880}{.357} - 0.5 \text{ pCi/l} \quad (\text{background in pCi/l, NOT cpm counts per min})$$

Or

$$2.5 \text{ pCi/l}$$

(2880 minutes is 48 hours)