



Pavia, 10/07/2026

On June 11, 2026, 4 1L HDPE bottles of water from the Sorgente Chiarella source were delivered to the LMR laboratory, following an agreed request for the radiometric analyses indicated below:

- Total alpha activity (including ^{226}Ra , but excluding ^{222}Rn and Uranium)
- Combined activity of ^{226}Ra and ^{228}Ra
- Beta and photon activity from artificial radionuclides.

The delivered samples were taken into charge, and 3 out of 4 bottles were immediately acidified with concentrated Nitric acid (pH=2) to preserve the sample for subsequent analyses and measurements.

Screening measurement in gamma spectrometry

A sample aliquot equal to 1L was counted in gamma spectrometry on a HPGe GEMAmetek-Ortec detector to evaluate the photon activity of any natural and non-natural gamma-emitting radionuclides.

Measurements of ^{222}Rn and alpha/beta gross

An aliquot of the acidified sample was immediately collected and prepared for direct measurement in liquid scintillation to determine the dissolved ^{222}Rn content. Likewise, they proceeded with the direct alpha beta gross measurement in liquid scintillation. A 50 mL sample, after preconcentration, was used for alpha beta gross measurement with ALBA 2000 (ELSE NUCLEAR).

Measurement of combined ^{226}Ra and ^{228}Ra

200mL sample aliquots were processed, and Radium was co-precipitated as BaSO_4 . One aliquot was then used for the extraction method with RADEX extracting cocktail and counted in PERALS. The other aliquot, instead, was filtered and counted in alpha spectrometry with ORTEC ALPHADUO. The activity of Radium-228 was measured in liquid scintillation beta on a low-energy window.

Tritium measurement

The determination of tritium activity (T, ^3H) in water (present as HTO) was performed as described in the analytical procedure OTW02 "Tritium in water" developed by Eichrom Technologies Inc. The measurement was carried out by liquid scintillation for a time of 30 min.

^{90}Sr measurement

The determination of ^{90}Sr activity is performed using the analytical procedure SRW01 "Strontium 89, 90 in Water" developed by Eichrom Technologies Inc. The preconcentration method is the one using $\text{Ca}_3(\text{PO}_4)_2$. The measurement of ^{90}Sr was carried out by liquid scintillation for a time of 60 min.



Results

Table 1- Activity concentration (pCi/L) of radioisotopes in Chiarella water samples

	alpha tot (pCi/L)- ²²² Rn	beta tot (pCi/L)	²²² Rn (pCi/L)	²²⁶ Ra (pCi/L)	²²⁸ Ra (pCi/L)	³ H (pCi/L)	⁹⁰ Sr (pCi/L)
Sample	<0.027	<0.02	33± 0.16	<2.7	<2.7	<26.48	<2.05

Operators

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