Interlaboratory comparison of ^{3}H and ^{14}C activity determination in water

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Scope of comparison

In the field of analytical measurements of any kind, quality assurance is one of the most important work to be done. One possibility to present the best possible results to clients, is the interlaboratory comparison, where multiple laboratories measure the same sample, thereafter the differences and errors can be revised and the methods corrected if necessary. In this particular case, the RadiÖko Ltd. radioanalytical laboratory and Laboratory for low-level radioactivities of the Ruđer Bošković Institute (RBI) performed an interlaboratory comparison for the determination of ^{3}H and ^{14}C activity in water samples.

Samples and measurement methods

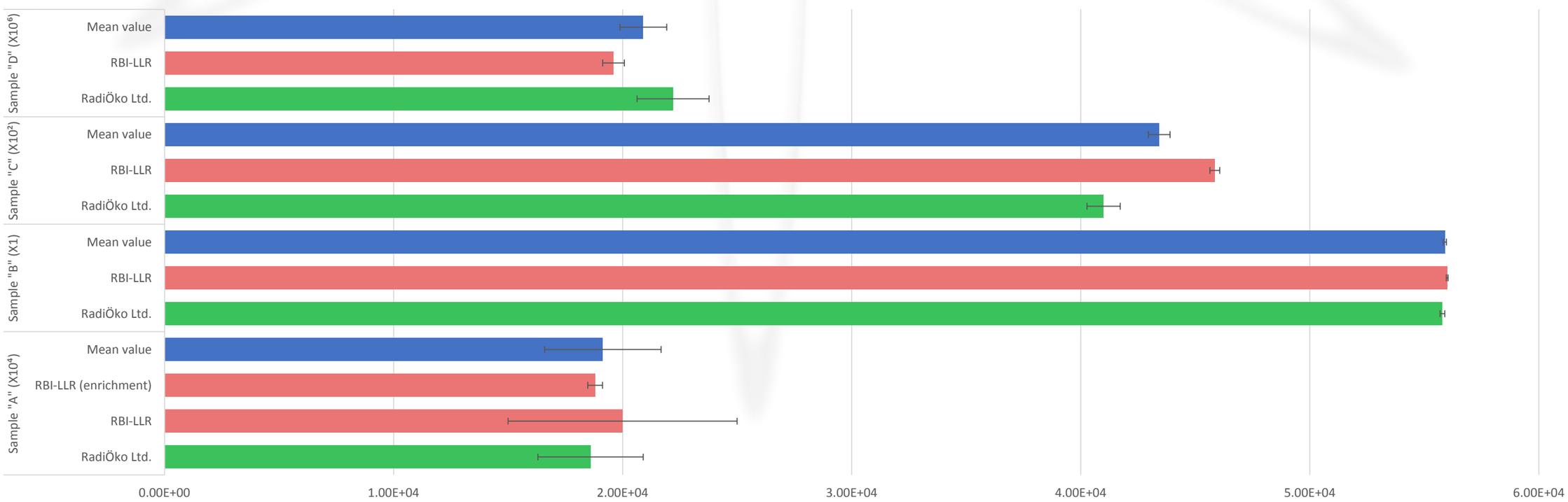
Three samples were measured for ^{3}H, two for ^{14}C activity. Each laboratory applied their own sample preparation techniques for ^{3}H determination and the activities were measured by LSC Quantulus 1220. In the RBI the low ^{3}H activity sample was measured with both direct, and electrolytic enrichment method. For the determination of the radiocarbon activity the Zagreb laboratory used AMS technique, whilst RadiÖko used an own developed sample oxidizer followed by LSC measurement using a Quantulus LSC.

Results

Results of the performed measurements can be seen in the following table:

No.	Measurand	Activity concentration ± uncertainty [Bq/dm³]		Mean activity concentration ± uncertainty [Bq/dm³]	Difference [%]	
		RadiÖko	RBI		RadiÖko	RBI
A	^{3}H	1.86E+00±2.30E-01 [1]	2.00E+00±5.00E-01 [1]	1.93E+00±3.65E-01	-3.69	3.56
	^{3}H		1.88E+00±3.20E-02 [2]	1.87E+00±1.31E-01	-0.54	0.53
B	^{3}H	5.58E+04±1.03E+02 [1]	5.60E+04±4.20E+01 [1]	5.59E+04±7.23E+01	-0.19	0.18
C	^{3}H	4.10E+02±7.29E+00 [1]	4.59E+02±2.15E+00 [1]	4.34E+02±4.72E+00	-5.75	5.44
D	^{14}C	2.22E-02±1.57E-03 [3]	1.96E-02±4.70E-04 [4]	2.09E-02±2.47E-02	6.03	-6.42
E	^{14}C	6.61E+00±9.72E-01 [3]	>2.5E-02 [4]	N/A	N/A	N/A

1. direct measurement; 2. after electrolytic enrichment; 3. Sample oxidizer; 4. AMS



Discussion

It is interesting to note that all three ^{3}H results of the RadiÖko group are lower than those obtained at RBI.
The results of the two radiocarbon measurements reveal that in the case of sample D the measurement results of the laboratories lie close to each other. Sample E had too high activity to be determined by AMS technique, this way it is not possible to compare the results.
In all the successfully conducted cases it is apparent that the differences are well below the 10% satisfactory range.