



GROSS ALPHA AND BETA ACTIVITY IN WATERS OF KASHKADARYA REGION AND OPPORTUNITIES FOR A TIERED APPROACH TO RADIOLOGICAL MONITORING

Javokhirbek Uktamov

Khojiakbarkhoja Akhrorov

Sarvar Samadov

Dilorom Sheralieva

Valeriya Saipova

Tashkent State Medical University, Uzbekistan

Abstract

The results of radiological screening of five drinking-water samples and four surface freshwater samples from Kashkadarya Region in 2025 are examined. Secondary analysis showed mean gross alpha activities of 0.07 and 0.05 Bq/kg, and beta activities of 0.90 and 0.80 Bq/kg, respectively. These values represent 50–70% and 80–90% of the comparison levels listed in the source. The table and chart reflect differences between the analytical channels. The limitations of group means and the grounds for repeat and radionuclide-specific analysis are discussed. A monitoring scheme that considers the water source, measurement quality and potential consumption pathway is proposed. The reported indicators do not characterize all water bodies in the region and do not permit dose calculation without additional data.

Keywords: Drinking water; surface water; alpha activity; beta activity; radiological screening.

Introduction

Gross alpha and beta activity is used for an initial description of the radiological quality of water. Such screening measures an aggregate signal and does not identify which radionuclides determine its magnitude. WHO's 2022 drinking-water guidelines [2] consider radiological indicators within a water-quality management system. For a regional study, it is important to link a laboratory value to the origin of the water and its actual consumption.

The aim of this article is to interpret the available summary results for Kashkadarya Region and identify opportunities for tiered monitoring. Particular attention is paid to the difference between a group mean and a decision concerning an individual sample. Surface water is considered a separate environmental medium; its inclusion in the study does not mean that the population consumed it without treatment.

Materials and methods of secondary analysis

The water table from the manuscript by Li M.V. and Yuldasheva F.U. [1], describing summer–autumn sampling in 2025, was analyzed. There were nine samples: five drinking-water and four





surface-water samples. The source identifies a UMF-2000 radiometer. Information on the origin of each sample, calendar dates, the detection limit and individual results is unavailable.

The heading of the second analytical block in the original table repeats alpha activity. It was interpreted as beta activity on the basis of the method description, the table caption and the paired comparison levels of 0.1 and 1.0. The Bq/kg unit was retained; conversion to Bq/L was not performed without density information. The $\pm$ values were reproduced without assigning them a statistical type. Each mean was calculated as a proportion of the comparison level in the original study. Values of 0.1 Bq/kg for alpha activity and 1.0 Bq/kg for beta activity were used. These numbers characterize the original comparison and are not presented as universal international criteria. Only descriptive analysis was performed.

Results of radiological screening

Mean alpha activity was 0.07 ± 0.002 Bq/kg in drinking water and 0.05 ± 0.001 Bq/kg in surface water. The corresponding beta activities were 0.90 ± 0.002 and 0.80 ± 0.002 Bq/kg. Means for the drinking-water group were numerically higher in both channels, but this does not establish differences among all water-supply sources.

Relative alpha activity values were 70% and 50%, and beta activity values were 90% and 80%. Thus, the beta channel was closer to the comparison level in the original table. Group means cannot determine the number of individual exceedances, because maximum values and the distribution of results are unavailable.

The chart is intended to compare relative indicators, not to calculate aggregate radiation risk. Alpha and beta signals cannot simply be added: their physical nature and the radionuclides contributing to them differ. Further analysis should address radionuclide composition and the reliability of the particular result.

Table 1. Water screening indicators and calculated proportions of the original comparison levels [1]

Water type	n	Alpha, Bq/kg	Beta, Bq/kg	Alpha / beta proportion
Drinking water	5	0.07 ± 0.002	0.90 ± 0.002	70% / 90%
Surface freshwater	4	0.05 ± 0.001	0.80 ± 0.002	50% / 80%

Comparison levels: alpha 0.1; beta 1.0 Bq/kg, according to [1]. The type of $\pm$ quantity is unspecified. The beta column was identified from the method description.

Discussion and tiered monitoring

The first step in the proposed scheme is to verify the units, sample preparation and analytical quality control. The individual result and its uncertainty should then be assessed. If these warrant clarification, repeat sampling and radionuclide identification are required. This sequence distinguishes a documentation error from a reproducible change in water.

For a drinking-water source, its type, water treatment and consumption are also important. WHO materials on food and water [3] provide context for intake assessment, while UNSCEAR [4] considers exposure within the broader structure of public exposure. However, these documents do not justify applying global dose estimates to nine local samples.



No comparison was made with water from an industrial site described in another supplied study: that study uses Bq/L and a different sampling scheme. Combining numbers without comparable methods and objectives would create an artificial trend. For regional monitoring, a common sample record is proposed while retaining separate analysis of each programme.

The IAEA's 2025 guide [5] supports the connection between monitoring results, decisions and reporting. External analytical checks provided through ALMERA [6] are useful for assessing the reliability of laboratory data. However, the small sample size and absence of repeat measurements limit conclusions about seasonality, geographical differences and stability of water quality.

Conclusion

Mean values in both analytical channels were below the comparison levels in the original study; the relative proximity of beta activity to those levels requires careful interpretation of individual data. Justified monitoring should include quality verification, repeat investigation when indicated and analysis of radionuclide composition. The data do not establish the absence of radiological problems in all water bodies of the region.

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