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Radioecological Monitoring In The Central Zone Of Azerbaijan

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A B S T R A C T

In the suggested article were investigated the distribution of natural radionuclides naturally – occurring uranium – series isotopic ratios which taken water samples from rivers, cannels, aquifers (artesian well) and soil cover in central regions of Azerbaijan. Quantity of radionuclides (^{226}R , ^{228}Ra, ^{40}K, ^{137}Cs) in water and soil samples determined by qamma-spectrometric methods. The products of ^{238}U radioactive decomposition rank ^{226}Ra which has a comparatively great decomposition period and ^{228}Ra intermediate product of ^{232}Th rank is observed in water and soil samples of the territories investigated. Activity of radionuclides (^{226}Ra, ^{228}Ra, ^{40}K,) in groundwater of investigation territory chances ^{226}Ra (0,15Bq/l-1,21Bq/l), ^{228}Ra(0,01Bq/l-1,55Bq/l) and ^{40}K (0,24Bq/l-63Bq/l) interval. Contents observed in the waters to be taken from artesian wells indicate that, natural radionuclides in their content are formed as the result of erosion processes in soil layers. Radionuclide contents of bottom sediments matched the content of the territorial land cover and were much lower than the level of the existing norms.

Key words: *artesian well, bottom sediment, gamma-spectrometer, marinelly, radionuclide, soil*

Introduction

The environment is exposed to pollution for because of different factors and the most dangerous is radiation pollution. The impact of radioactive pollution to ecology is different and creates great danger for the environment. Radiation sources have two groups – natural and anthropogenic (3). Sun's rays, i.e. rays that come from the cosmos, mining beams, scattered radiations of radionuclides in the soil, water and air arrange natural radiation of the earth. The natural radiation background of the earth consists of the sum of radionuclides in land, water and air and such radionuclides include ^{40}K, ^{238}U, ^{232}Th, and their fission products. The initial geological source of the most radionuclide background is the upper layers (facets, shale, sandstone, etc.) of lithosphere, it always arises under the impact in saprophyte microflora of soils, water and air (4). Through the world, irrigation (water for agriculture, or growing crops) is probably the most important use of water (except for drinking and filling up swimming polls, or similar). Almost 60% of all the worlds' fresh water without walls goes toward irrigation use. Largescale farming could not provide food the world large populations without the irrigation of crops of water gotten from rivers, lakes, reservoirs and wells. The South Caucasus region is one of the most unique places for environmental chemist and geochemist in the world from the perspective of geography, geology and natural/artificial affects.

Irrigation processes aren't applied much or at all in the irrigation and grass fields (1). The radioecological situation of these areas has been formed mainly due to natural processes. Impact of irrigation, fertilization and other factors affect the formation of radioecological situation of these areas to conduction the agrotechnical processes in fields for planting. The results show that, the quantity of radium isotopes in the fields of irrigation and pasture exceed comparatively to the farming lands. This shows that, the radium isotopes in the top layer of the soil are washed out as a result of the irrigation processes applied in agriculture. Along with elements for natural radioactivity a rage is also observed with isotopes with artificial and cosmic origins (^{137}Cs, ^{7}Be) in grass fields, these are in accordance with natural sedimentation processes from the atmosphere. Main source of irrigation water in the Central Aran zone is the Kur and Araz rivers.

Radionuclide content in the river and canals that flow in to the Central Aran zone and bottom sediment of the territory and artesian waters were investigated. Rivers, which crossed from this zone and connected to other water basins, took their sources from the southern slope of the Greater Caucasus Mountains and from Karabakh and Murovdagh ranges. These rivers are playing the role of carrier of geological and mineralogical information of the territory, where rivers took their sources. The Kur and Araz rivers are exposed by the impact of technogen and natural factors of both their sources and territories where the rivers flow. These waters are also used for the purpose of irrigation in territories of the regions being

investigated (6). Thus, the investigation of water and bottom sediments of these rivers allows characterizing the role in transport processes each of their radionuclides.

Material and Methods

Artesian water is widely used as drinking water in technical irrigation systems and everyday life and exposed less to the impact of the flowing water system of the territory where its formation is comparatively from h≥50 m depth.

Drinking water radioactivity is caused by the presence of natural and technically obtained radionuclides in rivers and lakes and also in underground water sources (subsoil water, artesian wells, and springs). The most important natural radionuclides from the point of view of their action to the human are K-40, U-238, U-235, Th-232 and the products of their radioactive disintegration: Ra-226, Rn-222. When these radionuclidies with drinking water come into man organism a source of internal alpha, beta- and gamma- irradiation is created there (9).

Main source of irrigation water in the Central Aran zone is Kur and Araz rivers. Rivers passed from this zone and joined to other water basins take their sources from south slope of the Great Caucasus Mountains and range of Karabakh and Murovdagh. Those rivers place a role of carriers of geological and mineralogical information of the territory where they took their sources. Kura and Araz rivers undergoes to industrial and natural factors of their sources and territories they passed. These waters are used in order to irrigate in the territories of regions investigated. So, investigation of water and sediments of these rivers is important to get radioecological information about territory. The Kura River is the main water systems which flow throw central regions of Azerbaijan and used as drinking and agricultural water. Kura River represents the main water-supply system of the South Caucasus. It originates in Turkey, from the springs on the northeast slopes of Kizil-Giadik, 2720 meters above the sea level. It flows through the territories of Georgia and crosses the Azerbaijan territory from its border with Georgia to the Caspian Sea. Its length is 1515 km and the surface of its basin is 188000 km^2 (5).

In the Figure 1 were shown the map of investigation area which was taken water and soil samples.

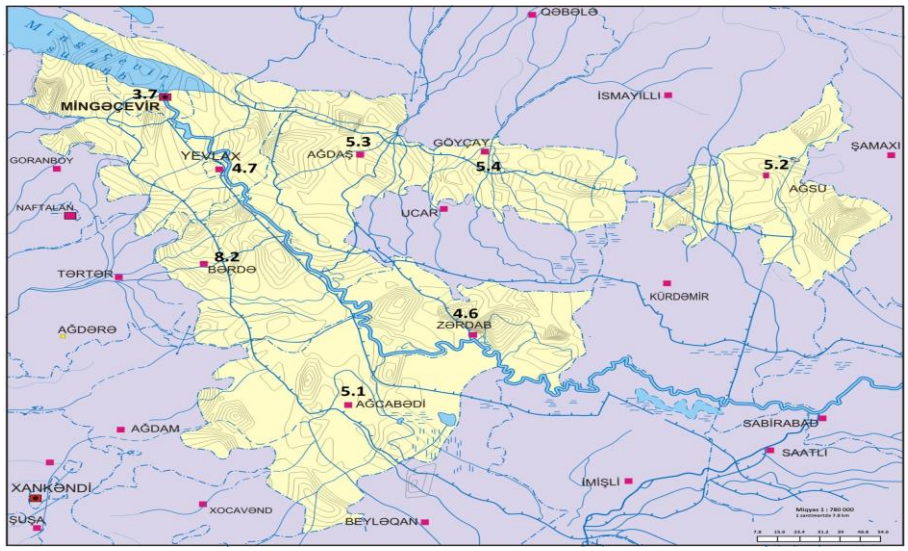


Figure 1. The map of investigation area

The main food source of Mingachevir water reservoir, Kür, Ganikh and Alazan rivers. The fields in the plains of Garabakh and Shirvan which are near Mingachevir water reservoir, in terms of territory and serviced canals, accepted water from the warehouse. Some analysis methods were used in order to study the radionuclide composition of samples received from the soil and especially from drilled wells in the investigation area. In most cases, radionuclide composition of samples received is impossible to analyze directly. The reason for this is the concentration of radionuclides in ground waters is lower than the sensitivity of the gamma-spectrometer device. This problem can be eliminated by thickening the water of the river and canal. Several methods (Evaporation, Extraction, Sorption etc.) were also used in order to eliminate the problem (8). Soil and water samples are taken from territories of different regions in order to learn the content of radionuclide in the zone of Central Aran. Sample preparation of water samples were spent on standard methods. The date and name of those places are noted after taking samples, and also exposure dose power was determined in the place where the samples were taken. Soil samples are taken in a sufficient quantity to fill a 1 liter container.

The samples taken are prepared for analysis as follows:

Soil samples are dried during 24 hours at the temperature of 323 K in a drying stove;

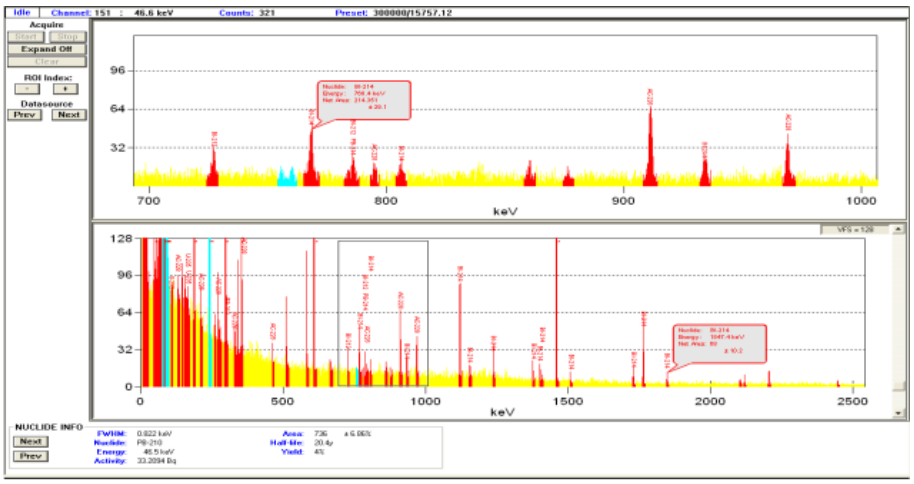
The dried samples are grinded in an incubation mill in a laboratory;

The mass of special 1 liter empty marinella container with its lid is noted considered for HP Ge gamma – spectrometric measurement is determined exactly once more;

Samples are filled to container provided to fill containers and is closed hermetically with its lid;

Those samples are prescribed exactly with mass of container;

Mass of sample inside those containers is calculated for masses and weights of full and empty containers;
Samples are kept in Marinelli containers closed hermetically for a month to reach radioactive soil samples in its content to radioactive balance;
Sample is analyzed in germanium detector HP Ge gamma – spectrometer after completion of storage period (1 month).



Error! Reference source not found.. shows gamma spectroscopy and radionuclide content of artesian well water which taken in investigation area

Nuclide content of rivers and channels flowed from Central Aran zone is investigated.

Resualtes

According to the groundwater, the Aran regions may be exposed to the impact of waste waters that are not very deep (h=5-10m). Radionuclide content of groundwater, not being deep from earth's surface in close territories to the Kur river, is compatible with each other within the appointment error with waters of the Kur river and these canals took sources from it. When taking groundwater from various depth in the collection of radionuclides comparatively exceed those in the layers and waters close to the surface.

The occurrence of a serious ecological change was observed in this zone after the establishment of the Mingachevir reservoir, and the releasing of water to the High Karabakh and High Shirvan canals. After irrigation systems were builtin High Karabakh and High Shirvan canals there was water leakage from the irrigation canals as it traveled to the fields (7). As a result, ground waters approached the surface with a different mineralization rate by the lops of time from the impact of irrigation water given over from the water demand of plants to fields. Therefore, the process of collection salts to the top layer of the soil started in separate areas and as a result the became soils salty.

In general, radionuclide content of groundwater is approximately the same to the radionuclide content of the land cover of the same territory which waters of the rivers and canals flowed in the territory, when it only deepened from the earth's surface, there is relative thickening that occurs (2). The river water is polluted by impact of human factors and in the result of drainage of salty underground waters in plain areas the salinity is increasing, the chemical structure becomes complicated and the water type changes. These cases are observed in Shirvan. In the streams of Kura flown from Mil-Garabagh lowland as well as in Kura itself and also in Aras river.

In the table 1 were shown the results of radionuclide analysis of natural radionuclides in rivers water samples, which were taken in investigation area.

Table 1. The results of radionuclide analysis

Rivers	Efficial activity Bk/l			Annual radionuclide Ci/l			
	^{226}Ra	^{228}Ra	^{40}K	^{226}Ra	^{228}Ra	^{40}K	A_{eff}
	The giver way 0,5Bk/l	0,2Bk/l	22Bk/l				
Kur river	0.36±0.12	0.39±0.25	12.5±0.2	247.5	202.5	4252.8	889.2
Akhsucay river	0.22±0.11	0.25±0.01	6.9±1.5	0.5	0.5	15.0	2.5
Goycay river	0.41±0.23	0.19±0.11	5.8±0.3	5.2	2.4	73.7	14.9
Alicancay river	0.38±0.04	0.58±0.13	34.6±0.3	4.1	3.2	90.5	16.2
Turyancay river	0.95±0.32	0.18±0.03	5.6±0.6	4.5	0.8	26.3	7.8
İncacay river	0.31±0.13	0.03±0.01	5.8±0.1	0.3	0.03	5.3	0.8
Xacıncay river	0.28±0.12	0.08±0.01	9.6±0.2	1.1	0.9	14.5	3.3
Kürəkçay river	0.14±0.05	0.34±0.08	8.5±0.6	0.4	1.0	25.4	4.0
Qarqarcay river	0.41±0.21	0.37±0.23	6.4±0.3	0.8	0.8	13.2	3.0
Tartarcay river	0.64±0.11	0.37±0.12	6.06±0.64	10.4	6.0	98.6	27.0

Radionuclide contents of bottom sediments matched the content of the territorial land cover and were much lower than the level of the existing norms. Contents observed of radionuclide content of bottom sediments indicates that, water flowing from the of territories that were investigated only carry the low-level radionuclides allowed in the development of natural background. Thus, a collection of radionuclides was not observed in any place among the bottom sediments.

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