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RADIOECOLOGICAL RISK ASSESSMENT OF ZANGILAN DISTRICT

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Abstract: This study was conducted in the Zangilan region to assess the radioecological risks, and radiation background measurements were carried out in 32 safe areas. The average value for each area was set at 6-7 μR / h. Water quality parameters and element properties were studied by taking samples from the rivers which pass through the territory of the region. Samples were analyzed by atomic absorption spectrometry for the determination of metal content after appropriate preparation, the concentrations were determined and compared with the permissible values in drinking water provided by the World Health Organization.

Keywords: Zangilan district, quality of water, radioecological risks

1. Introduction

Metal pollution of rivers has become a serious environmental problem as a result of rapid urbanization and industrialization [1-3]Metal contaminants enter rivers by anthropogenic sources, such as the long-term utilization of untreated and partially treated industrial wastes which contain toxic metals, or the use of metal-containing fertilizers and pesticides in agriculture. Metal contaminants are dangerous to the aquatic environment due to their toxicity, abundance, durability, and because of accumulation in aquatic environments [7,8]. Heavy metals have toxic properties and even small doses of heavy metals have serious impacts on human health. The effects of these environmental pollutants on human health are well known. The toxicity of heavy metals can lead to significant disease and decreased quality of life [9, 10]. Recognition of the importance of metal concentrations in river waters or the environment is increasing in pollution monitoring studies.

Zangilan district is located in the southeast of the Lesser Caucasus mountain range on the left bank of the Araz River. The region is bordered by the Republic of Armenia to the west and northwest, and the Islamic Republic of Iran to the south and south-east (Figure 1). As a result of the ruthless exploitation of the territory of the Zangilan region, which has been occupied by Armenia for 27 years, in violation of all international norms and principles, the environment has been subjected to serious environmental impacts and changes. As a result of purposeful changes in the region, looting of natural resources, and the use of weapons, ammunition, or military equipment for various purposes during the war, cause various types of pollution and created conditions for pollution of existing water sources.

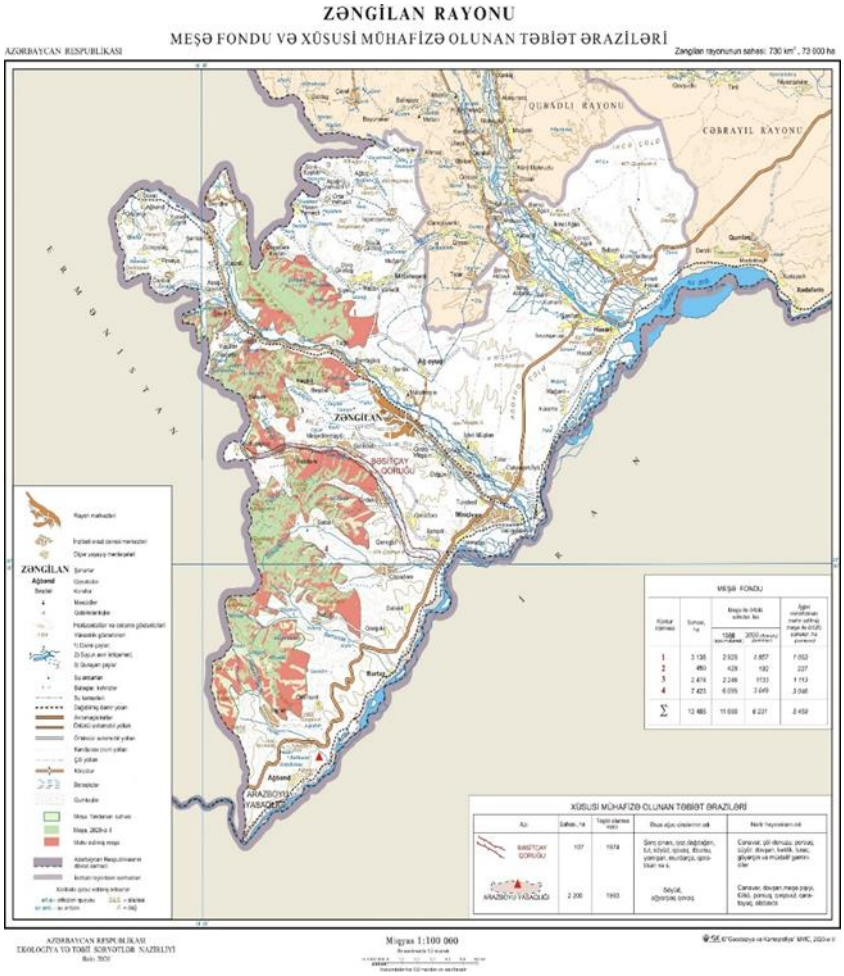

Fig. 1. Map of Zangilan district

In this study, radiation background measurements were carried out at safe sites in the region of Zangialan to assess radioecological risks in the liberated region, and water samples were taken to assess the quality of water by taking water samples from the Basitchay, Oxchuchay, and Hakari rivers.

The mouth of the rivers flowing through the territory of the Zangilan region and starting from the mountain ranges is the Araz River.

The Araz River - is the largest in the area, and it is the second main source of water in the country, which starts flowing from Turkey. Length 1072 km (77 km inside), water catchment area 102000 km2 (15700 km2 inside). River water is widely used for households, agriculture, and industrial purposes. Pollution of the river is carried out from Armenia. It should be noted that untreated wastewater is regularly discharged directly into the Araz River from Armenia and the amount of wastewater is about 2.1 thousand cubic meters/day.

Basitchay - Starting from the Bartaz plateau, Basitchay joins the Gikhovuz, Kukrataz, and Sobusu rivers. Passing through Baharli village, and at Razdara village it's called Razdarachay. Being the left tributary of the Araz River, its source comes from the Republic of Armenia. The length of the river is 44 km (17 km including the territory of Azerbaijan) and the catchment area is 354 km (156 km including the territory of Azerbaijan).

Oxchuchay - is the left tributary of the Araz River, taking its source from the Zangazur mountain (Gapijig Mountain) and its length is 82 km. The river's catchment area is 1,140 sq/km, with a flow of 5.9 cubic meters per second (minimum moist years), 10 cubic meters (average moist years), and 14.6 cubic meters per second (most moist years).

The river is polluted with waste from the villages of Armenia. Water is chemically polluted from the Gajaran copper-molybdenum and Gafan copper-ore refineries which are located in Armenia and also water is biologically polluted from Gafan-Gajaran (including villages, hospitals, and agricultural facilities), and wastes are discharged directly into the Oxchuchay without treatment, which all of them cause "Dead Zone" in the river basin.

43 km of the riverbed and 455 sq/km of the catchment area include the territory of Azerbaijan, and these areas are constantly polluted. As a result, the microflora and fauna of the river water were destroyed, and the process of self-purification completely stopped.

2. Research method

In this study, radiation background measurements were carried out at safe points areas to assess radioecological risks in the Zangilan region, and water samples were taken from Basitchay, Oxchuchay, and Hakari rivers to measure the water quality.

The water samples were filtered through a 0.45μm membrane filter using a two-hundred-milliliter plastic filtration device in preparation for the study, and a few drops of high-purity nitric acid were added to the filtrate to regulate to pH<2. Samples are stored at 4°C during transportation. All plastic containers, pipettes, filtration devices, and flasks were stored at 10% v/v HNO_3 for 24 hours and washed with ultrapure water before use. Ultrapure water (resistance 18.2 MΩ cm, pH (5.5-6.5)) was used in all laboratory operations.

The concentration of elements in water samples was measured by using the atomic absorption spectrometer system [11].

3. Conclusions and discussions

It is known that the physicochemical processes which take place in river systems have different characteristics depending on the water parameters. Therefore, it is important to constantly check these parameters for monitoring and also for research. At the same time, it is necessary to check the potential of rivers as a source of drinking water. The drinkability of water is one of the factors that necessitate the implementation of complex analyzes.

During radioecological monitoring in the Zangilan region, the exposure dose of gamma radiation was measured by using an IndetiFINDER-2 dosimeter-spectrometer. The measurements were carried out considering the requirements of the standard operating procedure and based on the observed radiation background values, the average value for 32 measurement points was set at 6-7 μR/h (Figure 2).

Fig. 2. Radiation background measurement points

To determine the quality of the samples, water parameters (pH, conductivity (Cond), Total solids (TDS), salinity (Sal), Dissolved oxygen (DO), temperature (T), and radiation background (R)) were measured, the results are given in Table 1.

Table 1

Water parameters of samples taken from Hakari and Oxchu rivers

Sample	pH	Cond.	TDS	Sal.	DO	DO	T	R
		µS/cm	mg/L	%	mg/L	%	^{o}C	µs/h
Oxchuchay	7.87	508	254	0.03	8.89	96.2	19.2	0.047
Zangilan, 3rdAghalı, Hakari rivers	8.04	320	160.7	0.02	9.59	103.6	19.1	0.043
Zangilan, korpu, Oxchuchay	7.93	506	253	0.03	8.44	91.3	17.2	0.047
Hakari river	7.96	228	114.1	0.01	9.46	101.9	18.9	0.043

The samples were analyzed for metal content by atomic absorption spectrometry after appropriate preparation, and the concentrations determined were compared with the permissible limits for drinking water provided by the World Health Organization (Table 2).

Table 2

The concentration of metals in samples (µg / L)

	Cr	Mn	Ni	Zn	Al	Fe
Hakari river, 3rd Aghalı	0.1	7.592	<0.20	23.18	34.74	137.26
Basitchay	1.96	3.485	<0.20	3.47	46.86	111.9
Fount	6.03	3.477	0.27	7.16	15.1	29.82
Oxchuchay 1	1.09	181.8	<0.20	1508.8	725.7	1823
Oxchuchay 2	1.45	170.84	0.53	732	629	2241
Hakari river	0.57	21.644	2.19	17.35	48.1	274.41
WHO	50	100	70	5000	200	300

The concentrations of metals observed in the samples are graphically depicted in Figure 3.

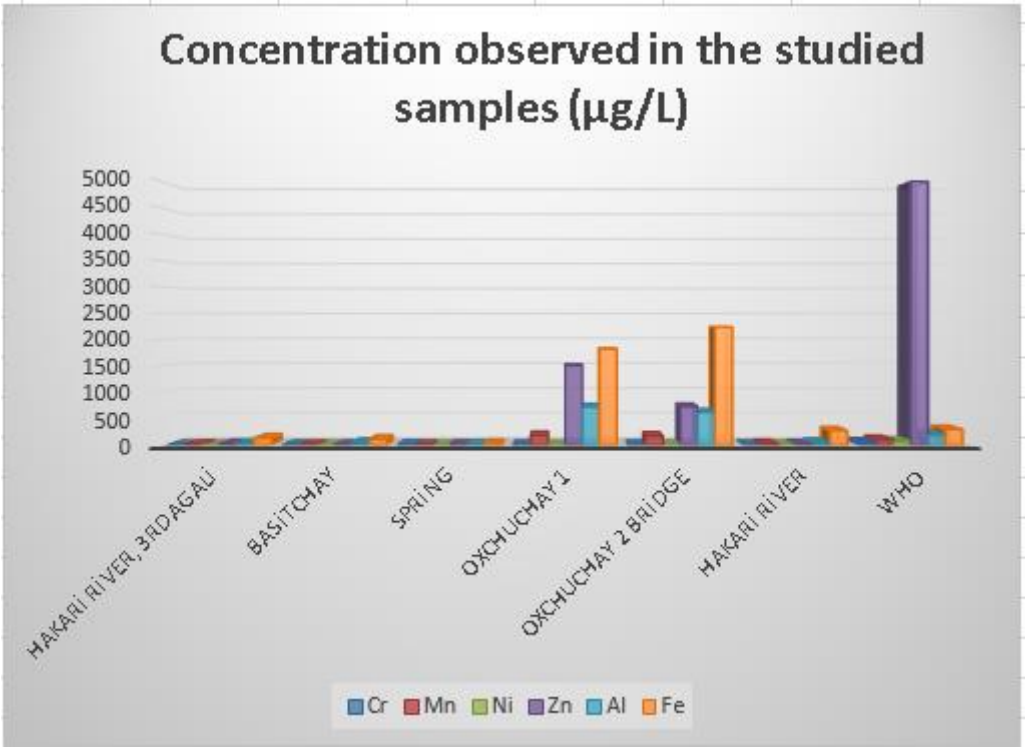

Fig. 3.

Conclusion: As a result of the research, measured values in Basitchay and Hakari river's water parameters and metal concentrations are lower than the limit value recommended by the WHO for drinking water. However, in Oxchuchay, which comes from the territory of Armenia and enters the territory of the Zangilan region of Azerbaijan, the concentration values are is more than the limit of 1.7-1.8 times for Mn element, 3.1-3.6 times for Al element, and 6-7.5 times for Fe element. It should be noted that the maximum value of electrical conductivity in drinking water is defined by the WHO as 400 µS/cm.

The permeability values (508 and 506 µS/cm) in the samples taken from Oxchuchay are higher than the limit value, which means that in the current situation the river cannot be used as a source of drinking water. All this confirms that the Oxchu River was exposed to anthropogenic pollutants before entering the country. At this level, the impact of heavy pollution on the river basin ecosystem is inevitable. Since it is not ruled out that the pollution process has been ongoing for many years during the occupation of the Zangilan region, it is necessary to continue research and monitoring of water and sediment samples from the riverbed in terms of comprehensive study and control of pollution.

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ОЦЕНКА РАДИОЭКОЛОГИЧЕСКОГО РИСКА В ЗАНГИЛАНСКОМ РАЙОНЕ

Ф.Ю. Гумбатов

Резюме: Для оценки радиоэкологических рисков в освобожденном Зангиланском районе в рамках данного исследования были проведены замеры радиационного фона в 32 пунктах, в которых обеспечены безопасности и установлено среднее значение по району на уровне 6-7 мкР/ч. Параметры качества воды и падение содержания химических элементов изучались путем отбора проб из рек, протекающих по территории региона, после соответствующих этапов подготовки пробы анализировались на содержание металлов методом атомно-абсорбционного спектра, а полученные концентрации сравнивались с допустимыми значениями в питьевой воды, предоставленной Всемирной организацией здравоохранения.

Ключевые слова: Зангиланский район, качество воды, радиоэкологические риски.

ZƏNGİLAN RAYONU ƏRAZİSİNDƏ RADİOEKOLOJİ RİSKLƏRİN QİYMƏTLƏNDİRİLMƏSİ

F.Y. Hümbətov

Xülasə: Bu tədqiqat İşində işğaldan azad olunmuş Zəngilan rayonu ərazisində radioekoloji risklərin qiymətləndirilməsi məqsədi ilə təhlükəsizlik təminatı olan 32 məntəqədə radiasiya fonu olçmələri icra olunmuş və ərazi üçün xarakterik olan orta qiymət 6-7 μR/saat müəyyən edilmişdir. Rayon ərazisindən keçən çaylardan nümunələr götürülərək su keyfiyyəti parametrləri və element tərki tədqiq edilmişdir. Nümunələr müvafiq hazırlıq mərhələlərindən keçirildikdən sonra atom absorbsiya spektrometri vasitəsilə metal tərkibinə görə analiz olunmuş, müəyyən edilmiş konsentrasiyalar Ümumdünya Səhiyyə Təşkilatı tərəfindən təqdim olunan içməli sularda icazə verilən hədd qiymətləri ilə müqayisə edilmişdir.

Açar sözlər: Zəngilan rayonu, su keyfiyyəti, radioekoloji risklər