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COMPARISON OF THE RADIATION SITUATION IN THE AGRICULTURAL AND OIL REGIONS OF THE ATYRAU REGION

Abstract. The article is devoted to the comparison of radiation levels in the Issatay and Makhambet districts of the Atyrau region. Atyrau region belongs to the regions of the oil-producing industry, which in turn can lead to environmental pollution, including radiation. Therefore, a radiation analysis was carried out to measure the exposure dose on the territory of the Isatai region, in which the oil-producing industry is developed, and for comparative analysis, the same measurements were carried out in the Makhambet region, where there is no industrial activity and the region belongs to an agricultural region. The studies carried out show that, according to the average values of the exposure dose in both regions, it is in close values, which range from 9 to more than 14 mR/h in the industrial region (Issatay region) and from 10 to 11 mR/h in the agricultural region (Makhambet region). In the Issatay district, according to the average values, there is a slight increased content. The data on the exposure dose rate at the entrance to the village and in the center of the village show that in the Makhambet district, the exposure dose data is higher in the center of the village than at the entrance to the village, while in the Isatai district the indicators at the entrance to the villages are, on the contrary, higher. In the Issatay region, within the villages, the data are similar to the Makhambet region, and outside the settlements, there is a slight increase associated with the additional load from oil pollution. The data on the level of measurement height show that at the level of the earth's surface and at the level of 50 cm, the values of the exposure dose are close in the values of the two regions, while there is a difference at the level of 1 m. In the Issatay region, the exposure dose is higher than in the Makhambet region, this may be due to the relatively greater accumulation of gaseous radioisotopes that accumulate as a result of evaporation from oil fields. The background radiation in both regions does not exceed the maximum permissible dose and is not hazardous to health.

Key words: exposure dose, background radiation, micro-roentgen, agricultural area, industrial area.

Introduction. Nowadays, the impact of radiation on human health is a matter of serious public concern. One of the most difficult problems is a major nuclear accident or the disposal of radioactive waste. Getting more information about radioactivity or natural radiation allows us to objectively understand the effects of radiation on human health [1].

In the broadest sense, radiation is the distribution of energy in space in the form of waves and particles. These include infrared, ultraviolet, light and many types of ionizing radiation.

Information on the radiation situation can be obtained using modern dosimeters. Therefore, for the timely detection of radiation, it is necessary to constantly monitor its level, assess its level and use measuring instruments correctly [2].

In the Atyrau region, there is a single areal increase in alpha activity up to 2.12 Bq/l and beta activity up to 1.76 Bq/l in the extreme northeast of the Kyzylkoga region in the Uil river basin.

In terms of beta activity, there is a second latitudinal areal increase in the north of Kurmangazy district with a maximum value of 1.37 in the water source with Asan [3]. This increase, as well as in the southwestern regions of the West Kazakhstan region, is not accompanied by a widespread increase in the values of alpha activity, except for the only water source in the village. Asan, in which the value of alpha activity exceeds the value of beta activity and is 2.01 Bq/l. At the same time, the values of the volumetric activity of radon in all studied areas of the Atyrau region do not exceed 4 Bq/l. In the Atyrau region, 4 territories (anomalous contours) with the highest radon hazard were identified: in the Kurmangazy region - 2 (anomalous median ERAA value - 26 Bq/m³), Kyzylkoga region - 1 (38), Zhylyoi region - 1 (31). During radiometric measurements in rooms, increased activity was detected only in 1.4% of the surveyed villages of the Atyrau region. In the Atyrau region, not a single excess of the EEVA of radon was found above the standard of 200 Bq/m³ for residential premises and 310 Bq/m³ for office premises. The number of increases in EEVA of radon from 100 to 200 Bq/m³: Kurmangazy region - 15, Zhylyoisky - 5, Kyzylkoginsky region - 4 [4].

In order to study the radiation state, we carried out research on the territories of two regions, which are very different from each other. The Makhambet region is located along the Ural River and the availability of fresh water contributed to the development of agriculture in this region. Issatay region is located off the coast of the Caspian Sea and the main activity in this region is oil production [5].

Methods. The basis of the presented material is the assessment of the results of radiation monitoring in the Makhambet and Issatay districts of the Atyrau region, which is understood as the radiation monitoring by the DRG-01T dosimeter. The absolutely safe level of radiation background for the population is 30 mR/h. The territories of 7 villages in Makhambet region (Almaly, Taldykol, Saraishyk, Zhalgansay, Makhambet, Tanday, Aktogay) and Issatay regions (Ergaliyev, Tushykudyk, Akkystau, Zhanbay, Naryn, Zineden, Issatay). The studies were carried out at the entrance to the settlement and in the center of the settlements at three levels: at ground level, 50 cm from the ground and 100 cm from the ground [6].

Results. Deterioration of the dynamic equilibrium of radionuclides in the environment occurs due to complex natural changes and human activities in agriculture and industry. There are two types of radionuclides in oil and gas pollution. The first type is associated with uranium-rich shale. The amount of uranium in the shale is 1000 g/t. The resulting Ra-226 gets into oil and gas and contaminates them with radionuclides. Thus, oil and gas are converted into radioactive substances. Currently, oil and gas are produced in different countries of the world and their radioactivity is measured [7,8].

Makhambet district - a district located in the central part of the Atyrau region, the center is the village of Makhambet. It is located 70 km from the regional center along the Atyrau-Uralsk highway. The surface is smooth. The soil is black and sandy. The main occupation of the population is agriculture. The Makhambet region is divided into the following administrative territories: the villages of Akzhaiyk, Aktogay, Alga, Almaly, Baksay, Beybarys, Esbol, Zhalgansay, Makhambet, Saraishyk [9].

Issatay district - a district in the north-west of the Atyrau region. Located off the coast of the Caspian Sea, desert, flat, saline, saline, dry soil layer. Mainly engaged in oil production. The Issatay region is divided into the following administrative territories: H. Ergaliyev, Tushikuduk, Akkystau, Zhanbai, Naryn, Zineden, Issatay [10].

The research results (figure 1) show that the average values of the exposure dose in the villages of the Makhambet and Issatay regions are at the same level from 9.0 mR/h (Almaly settlement of the Makhambet region) to 14.3 mR/h (Ergaliyev settlement of the Issatay region). Average values for all settlements are 10.6 mR/h in Makhambet district and 11.2 mR/h in Issatay district.

The values of the exposure dose at the entrance to the settlement and in the center of the settlements are also marked with different values (figure 2). This difference was especially noted in the Makhambet region for the villages of Taldykol (at the entrance - 7.6 mR/h and in the center of the village 13 mR/h), Saraishyk (at the entrance - 12 mR/h, in the center of the village - 9.3 mR/h), Aktogay (at the entrance 9.6 mR/h, in the center - 13 mR/h) and in the Issatay district for the villages of Zhanbay (at the entrance - 9 mR/h, in the center 10.6 mR/h), Zineden (at the entrance - 9.3 mR/h, in the center - 11 mR/h), Issatay (at the entrance - 12.3 mR/h, in the center - 7.6 mR/h). Outside villages, the exposure dose is less than in

the village itself, for example, in the villages of Taldykol, Makhambet, Aktogay, Zhanbay, Zineden. However, in some villages the opposite values are noted, for example, in the villages of Saraishyk, Akkystau, Issatay [11].

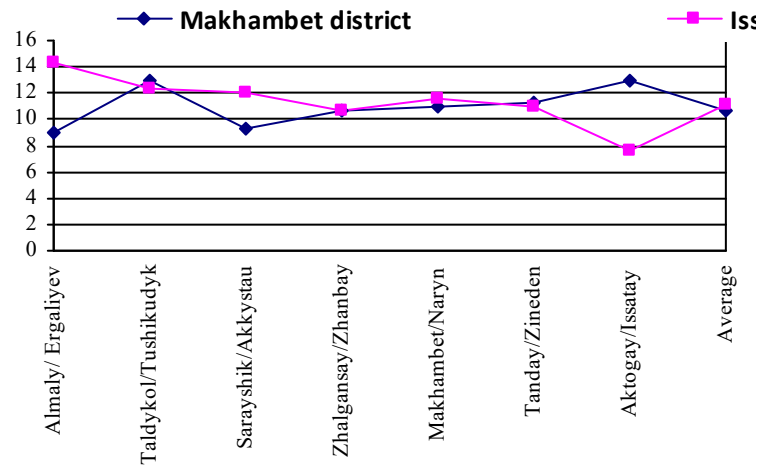


Figure 1 – Average values of exposure dose in Makhambet and Issatay districts of Atyrau region, mR/h

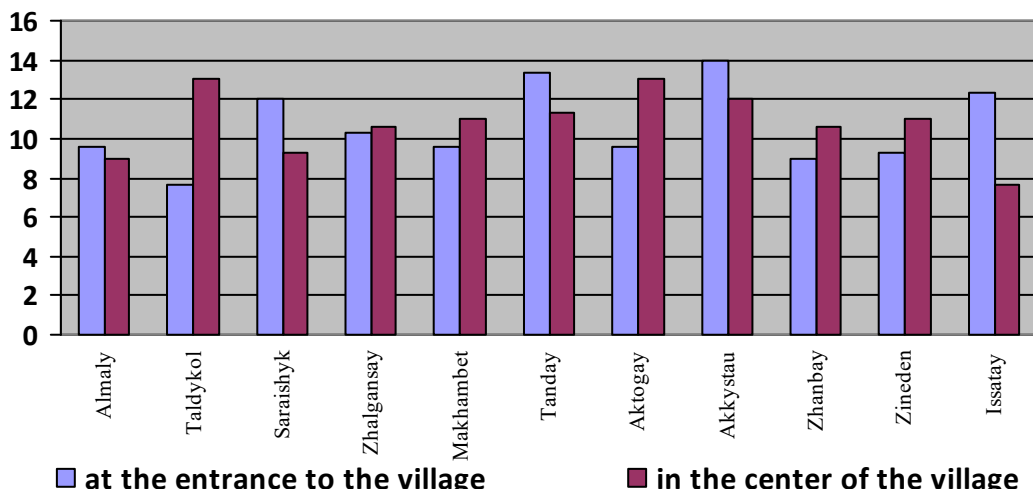


Figure 2 – Values of the exposure dose at the entrance to the village and in the center of the villages of Makhambet and Issatay districts

The exposure dose values at different levels have different meanings (figure 3). At the 0 cm level, the maximum values are typical for the settlements of Ergaliyev and Akkystau (15 mR/h) in the Issatay region and low values for the village of Issatay (Issatay region) - 7 mR/h, as well as Saraishyk (Makhambet region) - 9 mR/h. At a level of 50 cm, the maximum values are in the Taldykol settlement of the Makhambet region (16 mR/h) and 14 mR/h each in the Aktogay settlements of the Makhambet region and Ergaliyev of the Issatay region. The minimum values are typical for the village of Zhanabay (6 mR/h) and Naryn (7 mR/h) of the Issatay district. At a level of 100 cm, the maximum values were recorded for the village of Naryn, Issatay region (17 mR/h) and 14 mR/h each in the villages of Aktogay, Makhambet region and Ergaliyev, Issatay region [12].

If we take the average values for each level of exposure dose measurement (figure 4), then it can be noted that they are all close in value and range from 10.4 mR/h (at the level of 100 cm) to 11.3 mR/h (at the level of 0 cm) in the Makhambet region and from 11.2 mR/h (at the level of 0 and 50 cm) to 11.5 mR/h (at the level of 100 cm) in the Issatay region.

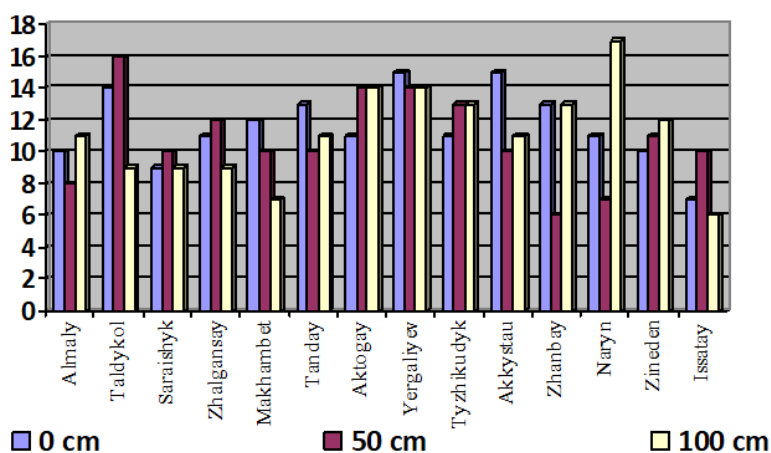


Figure 3 – Values of exposure dose for different levels of measurement of villages in Makhabet and Issatay districts

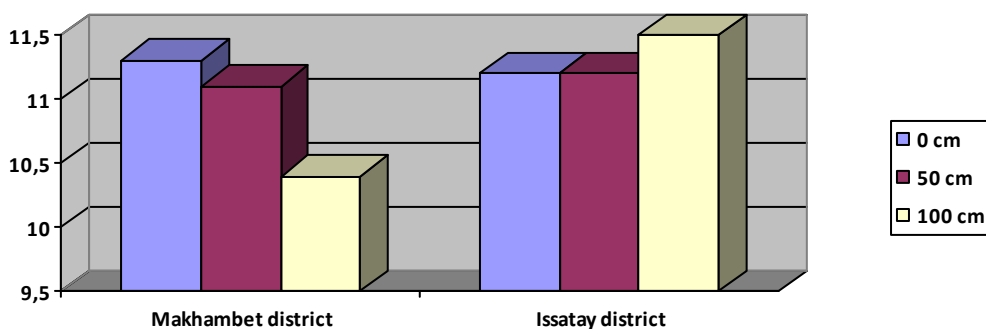


Figure 4 – Average values of the exposure dose for different levels of measurement in the villages of Makhabet and Issatay districts

In the general picture, the studies carried out showed that the exposure dose values ranging from 7 to 16 mR/h in the Makhabet region (the minimum values are typical for the villages of Taldykol and Aktogay at the entrance to the village, the village of Saraishyk and the maximum values in the village of Taldykol and at the entrance in the village of Tanday) and in the range from 6 to 18 mR/h in the Issatay district (the minimum values are typical for the village of Issatay and at the entrance to the village of Zineden, and the maximum values were observed at the entrance to the village of Akkystau and Issatay) [13,14].

Conclusion. According to the plan, control was carried out in two districts of the Atyrau region (agricultural and oil). For comparison: the Issatay region has a higher indicator than the Makhabet region. However, it is believed that the radiation background in both areas meets sanitary standards and does not significantly affect the life and health of the population.

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АТЫРАУ ОБЛЫСЫНЫҢ АУЫЛШАРУАШЫЛЫҒЫ ЖӘНЕ МҰНАЙЛЫ ӨНІРЛЕРДЕГІ РАДИАЦИЯЛЫҚ ЖАҒДАЙДЫ САЛЫСТЫРУ

Аннотация. Мақала Атырау облысының Исатай және Махамбет аудандарындағы радиация деңгейін салыстыруға арналған. Атырау облысы мұнай өндіретін аймаққа жатады, бұл өз кезегінде қоршаған ортаның, оның ішінде радиацияның ластануына әкелуі мүмкін. Сондықтан мұнай өнеркәсібі дамыған Исатай аймағы аумағында

экспозиция дозасын өлшеу үшін радиациялық талдау жүргізілді және салыстырмалы талдау үшін дәл осындай өлшеу жұмыстары Махамбет аймағында жүзеге асырылды, өндірістік белсенділігі жоқ және аймақ ауылшаруашылық өңірге жатады. Әр ауданда 7 ауыл зерттелді. Зерттеу ауылдар аумағына және әр ауылдың орталығына кіре алдында жүргізілді. Өлшеу жұмыстарында үш деңгейде: жер деңгейінде, жарты метр биіктікте және бір метрде жүргізілді. Зерттеулер көрсеткендей, екі аймақта да экспозиция дозасының орташа мәніне сәйкес, ол өнеркәсіптік аймақта (Исатай аймағы) 9-дан 14 мР/сағ. дейін және ауылшаруашылық аймағында (Махамбет облысы) 10-нан 11 мР/сағ аралығында болатын жақын мәнде болады.... Исатай ауданында орташа мәнге сәйкес мазмұны аздап жоғарылаған. Ауылға кіре берістегі және ауыл орталығындағы экспозиция дозасының коэффициенті туралы мәліметтер – Махамбет ауданында экспозиция дозасы туралы мәліметтер ауылдың кіреберісіне қарағанда ауылдың ортасында, ал Исатай ауданында ауылдардың кіреберісіндегі көрсеткіштер, керісінше, жоғары екенін көрсетеді. Бұл радиация фонының ауылдардан тыс төмендігінің нәтижесі болуы мүмкін, яғни радиациялық ластанбаған, ал ауылдардың өзінде электр энергиясын пайдалану табиғи радиацияны ішінара арттырады. Исатай ауданында, ауыл ішінде мәліметтер Махамбет ауданына ұқсас, ал ауыл сыртында мұнайдың ластануынан болатын қосымша жүктемеге байланысты шамалы өсім байқалады. Өлшеу биіктігінің деңгейі туралы мәліметтер жер беті деңгейінде және 50 см деңгейінде экспозиция дозасының шамалары екі аймақтың шамаларында жақын екенін көрсетеді, ал 1 м деңгейінде айырмашылық бар. Исатай аймағында экспозиция дозасы Махамбет аймағына қарағанда жоғары, мұнай кен орындарынан булану нәтижесінде жиналатын газ тәрізді радионуклидтердің салыстырмалы түрде көп жиналуына байланысты. Екі облыстағы радиациялық фон шекті рауалды мөлшерден аспайды және денсаулыққа қауіпті емес.

Түйін сөздер: экспозициялық мөлшер, радиациялық фон, микро-рентген, ауылшаруашылық ауданы, өндірістік аймақ..

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СРАВНЕНИЕ РАДИАЦИОННОЙ СИТУАЦИИ В СЕЛЬСКОХОЗЯЙСТВЕННОМ И НЕФТЯНОМ РЕГИОНАХ АТЫРАУСКОЙ ОБЛАСТИ

Аннотация. Статья посвящена сравнению уровней радиации в Исатайском и Махамбетском районах Атырауской области. Атырауская область относится к регионам нефтедобывающей отрасли, что в свою очередь может привести к загрязнению окружающей среды, в том числе и радиационной. Поэтому был проведен радиационный анализ по измерению экспозиционной дозы на территории Исатайского района, в котором развита нефтедобывающая отрасль и для сравнительного анализа проведены такие же измерения в Махамбетском районе, где отсутствует промышленная деятельность, и район относится к сельскохозяйственному региону. В каждом районе было исследовано по 7 поселков. Исследования проводились до въезда на территории поселков и в центре каждого поселка. Измерения были сделаны на трех уровнях, на уровне земной поверхности, выше на высоте полметра и на уровне одного метра. Проведенные исследования показывают, что по средним значениям экспозиционной дозы в обоих районах находится в близких значениях, что составляют от 9 до более 14 мР/ч в промышленном районе (Исатайском районе) и от 10 до 11 мР/ч в сельскохозяйственном районе (Махамбетский район). В Исатайском районе по средним значениям отмечается небольшое повышенное содержание. Данные по мощности экспозиционной дозы при въезде в поселок и в центре поселка показывают, что в Махамбетском районе данные экспозиционной дозы выше в центре поселка, чем при въезде в поселок, тогда как в Исатайском районе показатели при въезде в поселки, наоборот, выше. Это может быть результатом того, что за территории поселков радиационный фон ниже, то есть не наблюдается радиационного загрязнения, а в самих поселках использование электроэнергии частично повышает природную радиацию. В Исатайском районе внутри поселков данные схожи с Махамбетским районом, а за пределами поселков отмечается незначительное повышение, связанное с дополнительной нагрузкой от нефтяного загрязнения. Данные по уровню высоты измерения показывают, что на уровне земной поверхности и на уровне 50 см значения экспозиционной дозы близки по значениям двух районов, тогда как отмечается различие на уровне 1 м. Радиационный фон в обоих районах не превышает предельно-допустимой дозы и не является опасным для здоровья.

Ключевые слова: экспозиционная доза, радиационный фон, микро-рентген, сельскохозяйственный район, промышленный район.

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