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ХАБАРЛАРЫ

ИЗВЕСТИЯ

РОО «НАЦИОНАЛЬНОЙ
АКАДЕМИИ НАУК РЕСПУБЛИКИ
КАЗАХСТАН»
ЧФ «Халық»

N E W S

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NAS RK is pleased to announce that News of NAS RK. Series of geology and technical sciences scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of News of NAS RK. Series of geology and technical sciences in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential content of geology and engineering sciences to our community.

Қазақстан Республикасы Үлттық гылым академиясы «ҚР ҰҒА Хабарлары. Геология және техникалық гылымдар сериясы» гылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрi the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруды. Web of Science зерттеушілер, авторлар, баспашилар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабарлары. Геология және техникалық гылымдар сериясы Emerging Sources Citation Index-ке енүі біздің қоғамдастық үшін ең өзекті және беделді геология және техникалық гылымдар бойынша контентке адалдығымызды білдіреді.

НАН РК сообщает, что научный журнал «Известия НАН РК. Серия геологии и технических наук» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК. Серия геологии и технических наук в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по геологии и техническим наукам для нашего сообщества.



ЧФ «ХАЛЫҚ»

В 2016 году для развития и улучшения качества жизни казахстанцев был создан частный Благотворительный фонд «Халық». За годы своей деятельности на реализацию благотворительных проектов в областях образования и науки, социальной защиты, культуры, здравоохранения и спорта, Фонд выделил более 45 миллиардов тенге.

Особое внимание Благотворительный фонд «Халық» уделяет образовательным программам, считая это направление одним из ключевых в своей деятельности. Оказывая поддержку отечественному образованию, Фонд вносит свой посильный вклад в развитие качественного образования в Казахстане. Тем самым способствуя росту числа людей, способных менять жизнь в стране к лучшему – профессионалов в различных сферах, потенциальных лидеров и «великих умов». Одной из значимых инициатив фонда «Халық» в образовательной сфере стал проект Ozgeris powered by Halyk Fund – первый в стране бизнес-инкубатор для учащихся 9-11 классов, который помогает развивать необходимые в современном мире предпринимательские навыки. Так, на содействие малому бизнесу школьников было выделено более 200 грантов. Для поддержки талантливых и мотивированных детей Фонд неоднократно выделял гранты на обучение в Международной школе «Мираж» и в Astana IT University, а также помог казахстанским школьникам принять участие в престижном конкурсе «USTEM Robotics» в США. Авторские работы в рамках проекта «Тәлімгер», которому Фонд оказал поддержку, легли в основу учебной программы, учебников и учебно-методических книг по предмету «Основы предпринимательства и бизнеса», преподаваемого в 10-11 классах казахстанских школ и колледжей.

Помимо помощи школьникам, учащимся колледжей и студентам Фонд считает важным внести свой вклад в повышение квалификации педагогов, совершенствование их знаний и навыков, поскольку именно они являются проводниками знаний будущих поколений казахстанцев. При поддержке Фонда «Халық» в южной столице был организован ежегодный городской конкурс педагогов «Almaty Digital Ustaz».

Важной инициативой стал реализуемый проект по обучению основам финансовой грамотности преподавателей из восьми областей Казахстана, что должно оказать существенное влияние на воспитание финансовой грамотности и предпринимательского мышления у нового поколения граждан страны.

Необходимую помощь Фонд «Халық» оказывает и тем, кто особенно остро в ней нуждается. В рамках социальной защиты населения активно проводится

работа по поддержке детей, оставшихся без родителей, детей и взрослых из социально уязвимых слоев населения, людей с ограниченными возможностями, а также обеспечению нуждающихся социальным жильем, строительству социально важных объектов, таких как детские сады, детские площадки и физкультурно-оздоровительные комплексы.

В копилку добрых дел Фонда «Халық» можно добавить оказание помощи детскому спорту, куда относится поддержка в развитии детского футбола и карате в нашей стране. Жизненно важную помощь Благотворительный фонд «Халық» дал нашим соотечественникам во время недавней пандемии COVID-19. Тогда, в разгар тяжелой борьбы с коронавирусной инфекцией Фонд выделил свыше 11 миллиардов тенге на приобретение необходимого медицинского оборудования и дорогостоящих медицинских препаратов, автомобилей скорой медицинской помощи и средств защиты, адресную материальную помощь социально уязвимым слоям населения и денежные выплаты медицинским работникам.

В 2023 году наряду с другими проектами, нацеленными на повышение благосостояния казахстанских граждан Фонд решил уделить особое внимание науке, поскольку она является частью общественной культуры, а уровень ее развития определяет уровень развития государства.

Поддержка Фондом выпуска журналов Национальной Академии наук Республики Казахстан, которые входят в международные фонды Scopus и Wos и в которых публикуются статьи отечественных ученых, докторантов и магистрантов, а также научных сотрудников высших учебных заведений и научно-исследовательских институтов нашей страны является не менее значимым вкладом Фонда в развитие казахстанского общества.

**С уважением,
Благотворительный Фонд «Халық»!**

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DETERMINING THE IMPACT OF GRANULATED SLAG ON PUBLIC HEALTH

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Abstract. In our study, the indicators of ecologically unfavorable zones should be compared with similar data from control areas that are most favorable. According to the statistical system, it is possible to build a table of the dependence of the incidence of the population on the environment, multiplying the absolute indicators of diseases by 100,000 of the population and dividing it by the number of people living in the same area this year. The most polluted area was the Kazygurt microdistrict, located near the lead plant, and the control area - the Kaitpas microdistrict. The development of industrial production leads to environmental pollution, and pollution is carried out intensively, especially in cities where industrial enterprises are located. Intensive pollution of the main components of the environment with harmful substances, including heavy metals, has led to the formation of a biogeochemical province in many regions of Kazakhstan, characterized by excessive accumulation of pollutants. In this regard, research on assessing the health status of the population living in an ecologically unfavorable region is becoming the most urgent problem today. Hazardous to public health and even longer side effects of waste by polluting atmospheric air, soil, groundwater, open water bodies, agricultural products of plant and animal origin are indicated. The danger of waste is that they can contain all three factors: chemical, biological and physical, which can detrimental effect on human health.

Keywords: atmosphere, air, soil, water, plants, people

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ТҮЙІРШІКТЕЛГЕН ҚОЖДЫҢ ХАЛЫҚ ДЕНСАУЛЫҒЫНА ӘСЕРІН АНЫҚТАУ

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Аннотация. Біздің зерттеуімізде экологиялық қолайсыз аймақтардың көрсеткіштері негұрлым қолайлы болатын бақылау аудандарының ұқсас деректерімен салыстырылуы тиіс. Статистикалық жүйеге сәйкес аурулардың абсолюттік көрсеткіштерін халықтың 100 000 санына көбейтіп және осы жылы сол ауданда тұратын халық санына бөле отырып, халықтың аурушаңдығының қоршаган ортаға тәуелділігінің кестесін құруға болады. Ең көп ластанған аудан ретінде қорғасын зауытының жаңында орналасқан Қазығұрт шағын ауданы, ал бақылау ауданы - Қайтпас шағын ауданы алынды. Өнеркәсіптік өндірістің дамуы қоршаган органдық ластануына әкеліп соқтырып, әсіресе өнеркәсіптік кәсіпорындар орналасқан қалаларда ластану қарқынды жүзеге асырылады. Қоршаган органдың негізгі компоненттерін зиянды заттармен, оның ішінде ауыр металдармен қарқынды ластау Қазақстанның көптеген өнірлерінде ластағыштардың артық жинақталуымен сипатталатын биогеохимиялық провинцияның қалыптасуына әкелді. Осылан байланысты, экологиялық қолайсыз аймақта тұратын халықтың денсаулық жағдайын бағалау бойынша зерттеулер бүгінгі күні ең өзекті мәселе болып отыр. Атмосфералық ауаны, топырақты, жер асты суларын, ашық су айдындарын, өсімдік және жануар текті ауыл шаруашылығы өнімдерін ластау арқылы қалдықтардың халықтың денсаулығына қауіпті және уақыт бойынша одан да ұзақ жанама әсері көрсетіледі. Қалдықтардың қауіптілігі олардың құрамында барлық үш фактор болуы мүмкін: химиялық, биологиялық және физикалық, олар адам денсаулығына зиянды әсер етуі мүмкін. Өнеркәсіптік қалдықтарда кездесетін химиялық заттардың, қосылыстардың тізімі өте көп. Олар өнеркәсіпте синтезделетін және өндөлетін, өндірілген пайдалы қазбаларда кездесетін және алынған өнімдерде болатын барлық нәрсе болуы мүмкін. Қалдықтардағы

химиялық заттардың концентрациясы оннан, жүзден, мыңыншы миллиграммнан 1 кг-ға 1 тонна немесе одан да көп ондаған килограмға дейін өзгеруі мүмкін.

Түйін сөздер: атмосфера, ая, топырақ, су, өсімдіктер, шикізат

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ОПРЕДЕЛЕНИЕ ВЛИЯНИЯ ГРАНУЛИРОВАННОГО ШЛАКА НА ЗДОРОВЬЕ НАСЕЛЕНИЯ

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Аннотация. В нашем исследовании показатели экологически неблагополучных зон сравниваются с аналогичными данными контрольных районов, где они наиболее благоприятны. В соответствии со статистической системой выстраивается график зависимости заболеваемости населения от окружающей среды, путем умножения абсолютных показателей заболеваемости на 100 000 населения и деления на численность населения, проживающего в этом году в этом районе. Наиболее загрязненным районом был определен микрорайон Казыгурт, расположенный рядом со свинцовым заводом, а контрольным – микрорайон Кайтпас. Развитие промышленного производства приводит к загрязнению окружающей среды, особенно в городах, где расположены промышленные предприятия, загрязнение осуществляется интенсивно. Интенсивное загрязнение основных компонентов окружающей среды вредными веществами, в том числе тяжелыми металлами, привело к образованию биогеохимической провинции, характеризующейся избыточным накоплением загрязняющих веществ во многих регионах Казахстана. В этой связи исследования по оценке состояния здоровья населения, проживающего в экологически неблагополучной зоне, на сегодняшний день являются наиболее актуальными. При загрязнении атмосферного воздуха, почвы, грунтовых вод, открытых водоемов, сельскохозяйственной продукции растительного и животного происхождения показано опасное длительное

побочное воздействие отходов на здоровье населения. Опасность отходов в том, что они могут содержать три фактора: химический, биологический и физический, которые могут оказывать вредное воздействие на здоровье человека. Список химических веществ, соединений, содержащихся в промышленных отходах, многочислен. Они могут быть всем, что синтезируется и перерабатывается в промышленности, содержится в добываемых полезных ископаемых и содержится в полученных продуктах.

Ключевые слова: атмосфера, воздух, почва, вода, растения, сырье

Introduction

Airborne dust particles have a significant impact on human health because of their ability to carry and spread pollutants, allergens, and pathogens. The scientific basis for this influence is supported by the results of numerous environmental and occupational medicine studies. Exposure to dust particles can also increase the risk of cardiovascular disease because it is associated with inflammation and oxidative stress in the body. In addition, certain types of airborne dust particles may contain harmful chemicals such as lead, cadmium and asbestos that has long exposure to health.

To assess the level of environmental pollution of the area where located lead-mixed slag wastes, as part of the lead plant in Shymkent city, it is necessary to determine the content of slag dust, as well as the content of lead aerosols and inorganic dust (SiO_2) lifted into the atmospheric air on windy days. As a result of our research, at an average annual wind speed of 2.8 m/s, slag and SiO_2 -dust mixed with lead, measured in g/s, are emitted from the surface of granulated slag storage tanks into the atmosphere. The emissions of inorganic slag dust spread in the wind direction towards Kazygurt district settlement bordering the edge of the warehouse where it is stored.

In normative documents the ecological hazard of granulated slag dust is at the level of 3 class, and lead contained in slag dust is at the level of 1 hazard, with its MPC = 0.0003 mg/m³, and silicon dioxide (SiO_2)-at the level of 2 ecological hazard and its MPC = 0.02 mg/m³. Therefore, in order to improve the ecological condition of the locality, it is necessary to determine the coefficient of environmental safety. That is, the coefficient of ecological safety allows us to assess the results of measures taken to improve the ecology of the locality.

The development of industrial production leads to environmental pollution, especially in cities where industrial enterprises are located pollution is carried out intensively. Intensive pollution of the main components of the environment with harmful substances, including heavy metals, has led to the formation of biogeochemical province characterized by excessive accumulation of pollutants in many regions of Kazakhstan. In this regard, studies to assess the health status of the population living in the ecologically unfavorable zone are currently the most relevant.

Pollution of atmospheric air, soil, groundwater, open water bodies, agricultural products of plant and animal origin shows dangerous and even more long-term side effects of waste on public health. The danger of waste is that it can contain all three factors: chemical, biological and physical, which can have harmful effects on human health.

The list of chemicals, compounds found in industrial waste is numerous. They can be anything that is synthesized and processed in industry, contained in mined minerals, and contained in the resulting products. Concentrations of chemicals in waste can vary from tenths, hundredths, thousandths of milligrams per 1 kg to tens of kilograms per 1 ton or more. They mainly depend on the raw materials used, technologies used, production procedure, etc. In the Republic of Kazakhstan, there is almost no state system of waste management, which includes monitoring, storage, recycling and disposal of industrial and household waste. More than 20 billion tons of production and consumption waste, including 6.7 billion tons of toxic waste, are accumulated in the territory of Kazakhstan. As a result of these, soil, underground and surface water in many regions are subject to intense pollution by industrial waste. (Daribayev et al., 2023).

The problem of interrelation between the state of the environment and human health in the Republic of Kazakhstan is becoming more and more urgent every year. Pollution of the natural environment and its impact on human health have a relationship observed on the basis of data on the level of morbidity, emissions of pollutants into the atmosphere from stationary sources, discharge of polluted wastewater into water bodies, formation of toxic wastes, access of the population to drinking water and water quality, etc. The problem of interrelation of the state of the environment and human health in the Republic of Kazakhstan is becoming increasingly important. According to the environmental monitoring data, in many cities connected to the monitoring network, the pollution level still exceeds sanitary and hygienic norms. In 2017, the highest level of air pollution was observed in Almaty (API=12.6), Shymkent (API =11.2), Aktobe (API =9.5), Ust-Kamenogorsk (API =7.2), Temirtau (API =8.6), Ridder (API =9.0). High air pollution in the cities of Ust-Kamenogorsk, Shymkent city, Aktobe city, Ridder city, Temirtau city was formed due to the impact of emissions of non-ferrous and ferrous metallurgy enterprises, unfavorable climatic conditions in Almaty for the spread of impurities. The quality of drinking water in Astana city, Kyzylorda city and South - Kazakhstan regions is low. In Kyzylorda region the non-compliance of samples on sanitary and chemical indicators on tap water is 5.1%, on microbiological indicators-5.3 %, on decentralized sources - 23.4 % and 6.5 % respectively. Report on the number of socially significant diseases with an established diagnosis for the first half of 2018–2023 was registered for the first time in life.

A number of studies aimed at studying the state of the environment and public health in ecologically unfavorable areas of the republic have revealed a significant increase in the content of many Eco toxicants in the atmospheric air, for example, the concentration of cadmium is 260 times higher than the MAC values, copper - 45 times, lead - 60 times.

According to the data of the Hydrometeorological Center of Turkestan Region «Kazgidromet», the main source of air pollution is the closed joint-stock company «Yuzhpolimetal» in Shymkent city. (Ikramov et al., 2023).

It is often mentioned in the literature that in polluted areas the general morbidity of the population has increased by 1.5–2 times. The frequency of allergo dermatoses in industrialized cities is 5–6 times higher than in the "clean" region. Differences in the level of anemia between these areas are also obvious - 4 times higher in the «dirty» zone.

Damage to the central nervous system, liver, kidneys, and blood system may manifest itself as xenogenic intoxication syndrome. The occurrence of mental retardation, anemia can be caused by environmental pollution with lead. Many research papers have been published in the scientific literature on determining the distribution of dust in various environmental conditions. The authors quantitatively studied the emissions of salt dust carried by the wind from the dried bottom of the Aral Sea, in particular its volume and directions (Ikramov et al., 2023). There is also an association between increased mortality from bronchitis, bronchial asthma, pulmonary emphysema, respiratory diseases and environmental pollution. For example, children living in an ecologically polluted zone are 2 or more times more likely to suffer from chronic pneumonia, tonsillitis, neuropathy, and physical development lags compared to the morbidity rates in a «clean» zone. Lead (Pb) toxicity to plants,

the interest of scientists in the rich toxic effect on animals and humans began to be aroused. (Daribayev et al., 2023).

Research materials and methods

Under conditions of aerogenic chemical load, the respiratory system is an obstacle to the penetration of chemical compounds into the body and becomes a point of application of their toxic effect, because among all internal organs and systems of the human respiratory system is in close contact with environmental factors, primarily with the atmospheric air. The urban lead burden is evident among humans, wild and domesticated animals, and plants. Animal lead exposures closely mirror and often exceed the lead exposure patterns of their human partners (Ronnie Levin et al., 2020).

For example, 60 % of airborne lead is absorbed in the blood, 10% from water and 5 % from food. The ingestion of Pb at a dose of 105–204 µg per day results in a rapid increase in its concentration in the blood, so the concentration of Pb in the blood can be an indicator of environmental exposure to the body. The blood Pb content of non-Pb in humans has been observed to be as low as 12 µg, gasoline salesmen-18 µg, garbage collectors-54 µg, and motor vehicle workers-from 25 to 212 µg. As a favorable effect on the worker's body, but not on the population, its concentration in the air is considered 0.15 mg/m³. Air in the body, i.e. urine, contains Pb about 0.13 mg/l, blood — 70 µg. In this regard, special attention is paid to determining the level of atmospheric pollution. Multi-life cycle (MLC) recycling of lead is an effective way to achieve the sustainable development of the lead industry, but the comprehensive effect of resource utilization and environmental impact in the process is difficult to evaluate (Haixia Li et al., 2023).

It should be noted that the structure of morbidity has a certain relationship with the ecological features of the regions, which can be determined when analyzing the statistical data of medical institutions. Removing the offending exposure and lowering the overall body burden are essential to addressing heavy metal toxicity. Children are more prone to HM poisoning (especially lead) due to their growing neurological systems and demand specific attention (Julekha Khatun et al., 2022).

According to the data, in elementary school No. 49 of Kazygurt microdistrict, currently two pupils suffer from heart failure, 4 from obesity, 6 from goiter and 18 from chronic cholecystitis. In 3 years, 2 people died from blood cancer: a teacher and a 5th grade pupil.

In our study, the indicators of environmentally disadvantaged areas should be compared with similar data of control areas, where they are the most favorable. In accordance with the statistical system, we can plot the dependence of population morbidity on the environment by multiplying absolute morbidity rates by 100,000 populations and dividing by the number of people living in the area that year. The most polluted area was Kazygurt microdistrict, located near the lead plant, and - Kaitpas microdistrict.

Let's look at the major diseases with the highest proportion of the total disease structure.

In the general structure of adult morbidity in the studied settlements, respiratory diseases take the first place. Since 2020, there has been a sharp increase in the incidence of pneumonia, bronchitis, vasomotor and allergic rhinitis in adults, and in recent years the morbidity, in turn, has been increasing. This has been found to be associated with high environmental pollution with lead compounds and other heavy metals. Heavy metal exposure from anthropogenic pollutants negatively affects many marine organisms, including foraminiferan protists. As such, foraminifera are often used as bioindicators of stressed environmental conditions (Amanda et al., 2021).

Research results and discussion

The incidence of pneumonia in children in the polluted area (Kazygurt microdistrict) from 2018 to 2020 was recorded 1.9 times more often than in the most favorable area (Kaitpas microdistrict). In children under 14 years of age in the Kazygurt microdistrict, pneumonia incidence rates have been rising sharply since 2020. In 2021, 183 children with pneumonia are registered in Kazygurt microdistrict, which is 1.9 times higher than in Kaitpas microdistrict. Although there has been a slight decrease in incidence since 2021, the incidence rates are 1.6 times higher than in the 2023 clean neighborhood. In 2021, there is a 20-fold increase in adult incidence. There is a slight decrease in subsequent years, but compared to the Kaitpas neighborhood, incidence rates remain high: 8.5 times higher in 2022 and 7.6 times higher in 2023, as shown in Figures 1 and 2.

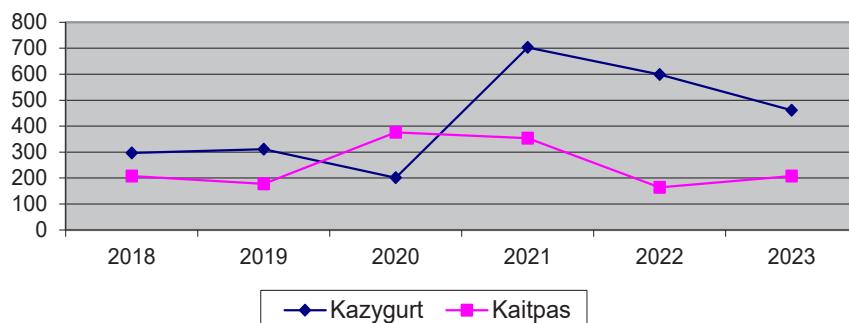


Fig. 1 relative incidence of pneumonia in children in the studied areas per 100,000 people

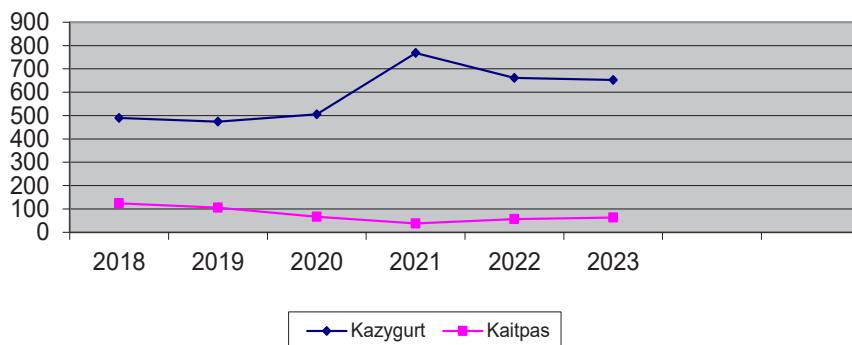


Fig.2 relative incidence of pneumonia in adults in the study areas per 100,000 people

The purpose was to reveal the intrinsic relationship between soil microbial, enzyme activities and heavy metal pollution, and to establish the characterization system of enzyme activities, soil heavy metal pollution degree, as well as microbial parameters (Bo Tang et al., 2022).

Characterizing the frequency of various diseases, it is necessary to note the high level of detection of respiratory diseases, in which chronic bronchitis occupies the leading place. Children's organism is influenced by environmental factors, unlike the adult population. In the structure of the general morbidity of respiratory diseases of children under 14 years of age, there is a sharp increase in the incidence of bronchitis in 2021 in 11 times compared to the previous year and an increase of 14 times compared to the clean area. The highest incidence rate of bronchitis in adults in Kazygurt microdistrict is in 2021 (1977 cases), 24 times more than in Kaitpas microdistrict, and although there is a decreasing trend in subsequent years, Figures 3–4 show that high incidence rates persist.

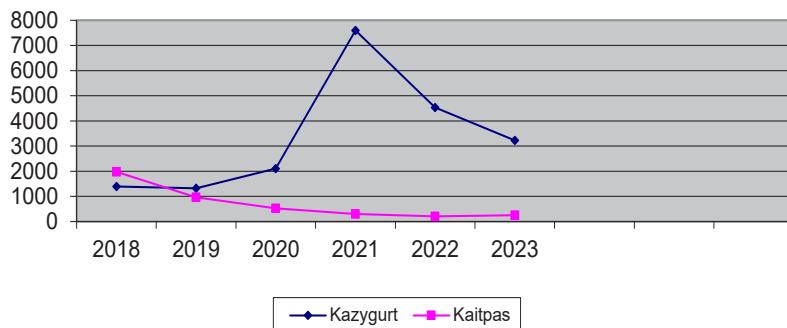


Fig.3 The relative incidence of bronchitis in adults in the studied areas is per 100,000 people

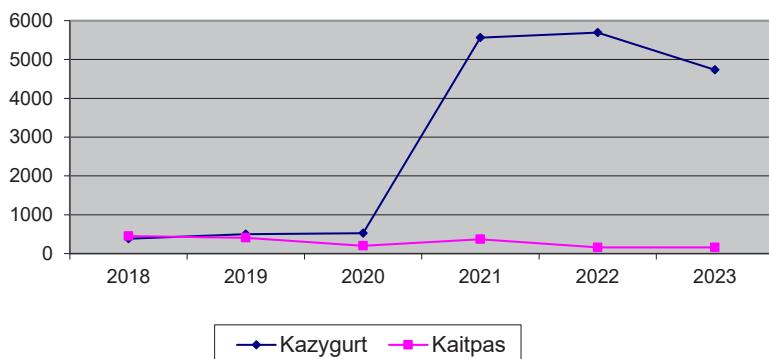


Fig.4 relative incidence of bronchitis in children in the study areas per 100,000 populations

Biomonitoring is a well-established method for assessing people's exposure to contaminants in the environment. Many non-communicable diseases can be prevented or aggravated by physiologically monitoring heavy metals in biological matrices such as urine, evaluating their association with non-communicable diseases, and attempting to limit exposure to them (Majid Hashemi et al., 2023).

During 6 years, diseases of the ENT organs, in particular vasomotor and allergic rhinitis, prevail in the dynamics of respiratory diseases. The comparable incidence of vasomotor and allergic rhinitis in children in the study areas shows an increase from 2020 to 2018. While in 2019, 295 sick children were registered in the residence around the lead plant, in 2021, 748 sick children are detected, and in the clean neighborhood there are no cases in this year. And in 2023, the number of registered children will reach 945. In the general surveillance area, the lowest incidence rates are seen in adults for 6 years. And the fact that from 2021 onwards, the rates in both children and adults will decrease to zero is shown in Figure 5-6.

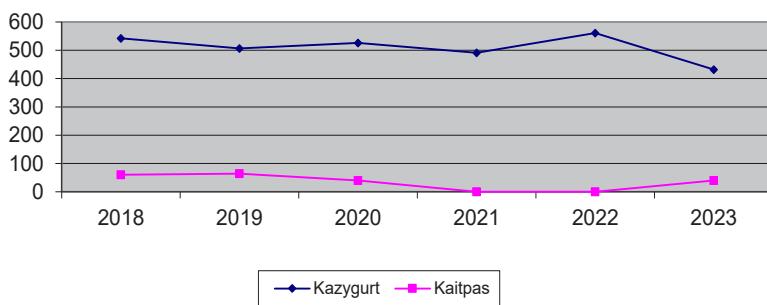


Fig.5 Relative incidence of vasomotor and allergic rhinitis in adults in the studied areas per 100,000 people

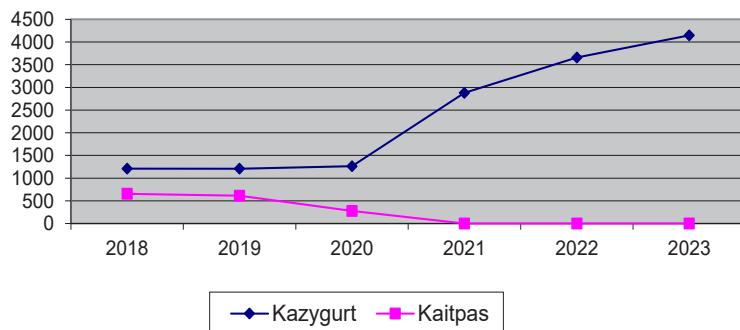


Fig.6 relative incidence of vasomotor and allergic rhinitis in children in the studied areas per 100,000 people

Fe-deficiency anemia occupies the leading place in the structure of diseases of circulatory organs. As shown in Figure 7-8, it has increased dramatically in both adults and children since 2019. In 2020, incidence rates in children under 14 years of age are 3.6 times higher compared to the reference area. Heavy metals (HMs) from smelters pose severe challenges to the environmental soil quality of surrounding farmlands, and threaten human health through the food chain (Jun Xu et al., 2023). The rates remain at the same level until 2021, and from that year onwards there is a decline in incidence rates in the contaminated areas. Even so, incidence rates in this region in 2023 are 1.2 times higher than in the control area. In adults, the incidence rate remains high in subsequent years.

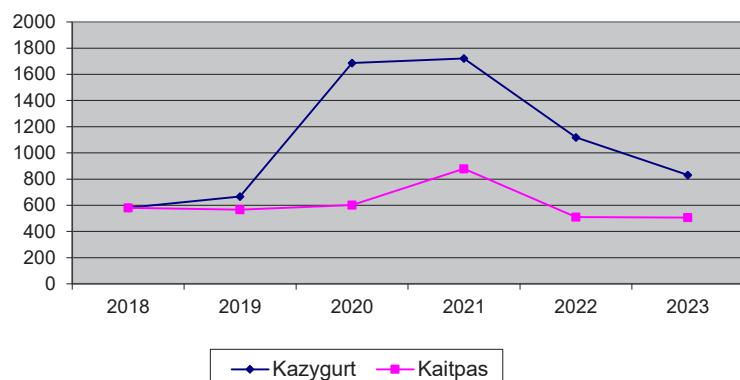


Fig.7 Relative incidence of Fe-deficiency anemia in children per 100,000 inhabitants in the studied areas

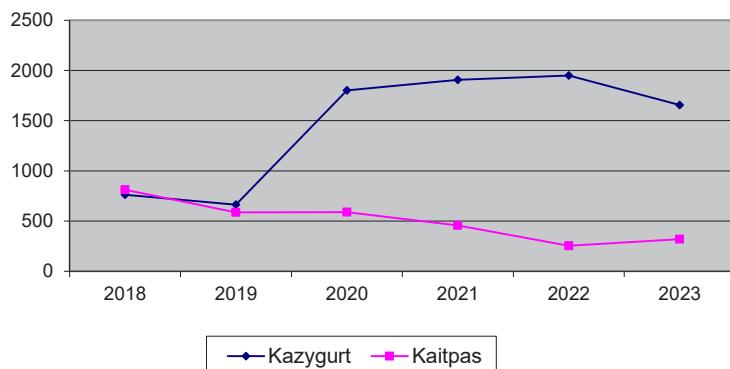


Fig.8 Relative incidence of Fe-deficiency anemia per 100,000 population in adults in the study areas

This can be done at work by putting on advancing industrial engineering, personal protective equipment, and following safe work procedures. The persistence of the stabilization effect of amendments on heavy metals (HMs) is of great concern when they are used for remediating HM-contaminated soil (Youfa Luo et al., 2023).

Heavy metals (HM) toxicity is becoming a major threat to living organisms in recent years due to the increase in population and anthropogenic activities. Lead (Pb) shares about 10 % of total pollution produced by heavy metals(Samuel Collin et al., 2022).

Heavy metals are used in industrial applications, such as production of pesticides, batteries, alloys, and textile dyes. Excessive exposure may lead to specific disorders. The kidney is a target organ in heavy metal toxicity because of its ability to reabsorb and concentrate divalent metals. The extent of renal damage depends on the nature, the dose, and the time of exposure. In general, acute damage differs from chronic damage in its mechanism of toxicity (Paolo Lentini et al., 2019).

In the dynamics of the relative incidence of genitourinary morbidity of children in the area of residence around the lead plant, there is an annual increase in the number of registered patients. From 2018, the number of children under 14 years of age who became ill increased from 204 to 648 by 2023. Heavy metal contamination especially lead (Pb) causes a serious threat to global public health (Yaping Wang et al., 2023). Lead(Pb), cadmium(Cd), and arsenic(As) are highly bioaccumulative and hazardous to human health [Cheng Peng et al., 2023]. This is 2 times the rate of the most favorable area. Figures 9–10 below show the relative incidence of genitourinary disease in children and the relative incidence of digestive disease in adults.

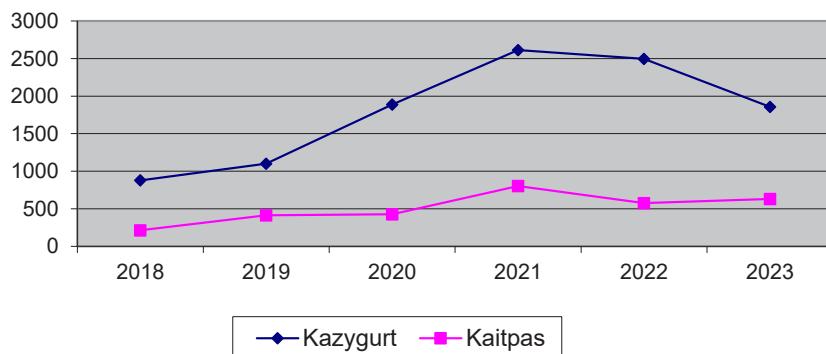


Fig.9 Relative disease of the genitourinary system in children in the studied areas per 100,000 people

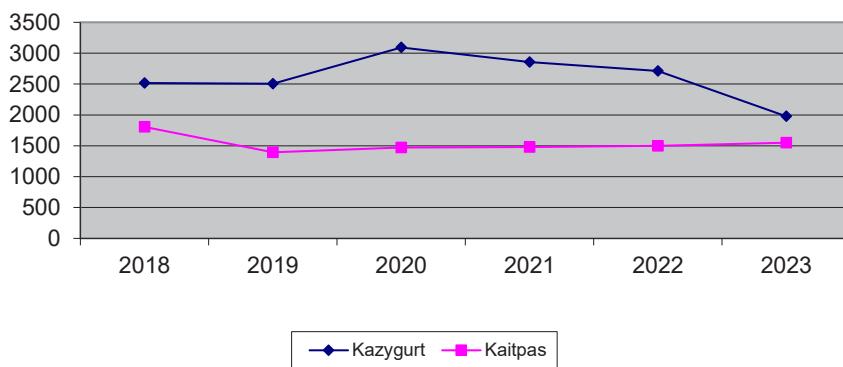


Fig.10 relative morbidity of digestive organs of adult population of the studied areas per 100,000 populations

Conclusion

The analysis of morbidity shows that, according to the literature, the general morbidity of the population in the studied contaminated zone has increased 1.5–2 times. Where you live around the lead plant, we can talk about a higher prevalence of respiratory diseases in both adults and children, while in the control zone it is much less common.

We also found a high incidence of genitourinary, circulatory and digestive diseases in the contaminated area. All this is related to the impact of xenobiotic - in lead pollution zones, the influence of other causes of bronchopulmonary diseases is often increased, resulting in a significant increase in the morbidity of the population near the sources of pollution, which indicates the negative impact of industrial waste on health.

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