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UDC 631.4:546.3:001.18

G.Zh.Mukasheva[1], B.Zernke[2], M.A.Mukasheva[1]

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About the ways of biological participation of iodine in maintenance of homoeostasis and determination of iodine deficiency in an organism

Deficiency of iodine in environment is the long-term factor which doesn't change throughout centuries of human existence. Certainly, in iodic security of an organism food plays large role, by means of which geochemical features of the territory and social conditions are realized. Results of numerous researching work by iodic security of an organism testify that in the conditions of lack of iodic prevention, iodine deficiency conditions of the population have mass character. By carrying out hygienic researches on Kazakhstan, practically in all regions, in a varying degree, iodic insufficiency was revealed.

Key words: thyroxine, diiodotyrosine, triiodothyronine, oxidizing processes, toxic hyperfunction, pathological processes.

The main biological function of iodine consists in maintenance of a thyroid gland and creation of a hormone — a thyroxine. Iodine is the only microcell participating in formation of a hormone, making deep and strong impact on the general development of an organism. Iodinated hormones — thyroxine, diiodotyrosine, triiodothyronine, increase oxidizing processes and influence to the general physical and mental development [1]. Deficiency of these hormones causes development of the compensatory and adaptive reaction directed on maintenance of a hormonal homeostasis, hypertrophy, to iodine capture increase by a thyroid gland and increases in formation of yodtironin in an organism [2]. Increasing of yodtironin level in blood oppresses tireotropny function of a hypophysis and indirectly sekretory activity of a thyroid gland that causes development of a hypothyroidism [3]. Formation of a hormone of a thyroid gland is defined by synthesizing diiodtiroziny, further by thyroxine which by joining with protein, turns in thyreoglobulin [1–3].

Allocation of a thyroid gland hormone is carried out by the impulses proceeding from the central nervous system, at getting in blood it suppresses secretion of a thyritropic hormone of a hypophysis. At small quantity of a thyritropic hormone activity of a thyroid gland is weakened and, so, allocation of a thyroxine, thus, stops suppression of a hypophysis, and the hypophysis begins to throw out the thyritropic hormone activating formation of a thyroxine etc. At insufficiency of iodine thyroxine isn't formed and the thyritropic hormone continues to activate a thyroid gland, causing its swelling. If enter iodine into an organism secretion of a thyroxine is restored, the thyritropic hormone suppressed and a thyroid gland is normalized. A physiological role of a thyroxine is the formation of iodine which controls the main exchange: the water-salt, fatty and carbohydrate.

Thyroxine is in a constant communication with a hypophysis and sexual glands, participating in regulation of activity of the central nervous system, influencing the emotional status and activity of cardiovascular system. Deficiency of iodine is widespread among the population of Kazakhstan, which is shown by increasing of a thyroid gland (an endemial craw). The hypothyrosis (insufficiency of function of a thyroid gland) can develop. During the diagnosing on a deficiency of iodine condition among the children's population of Kazakhstan in all areas was noted the intense situation, moderately expressed deiciency of iodine revealed

among all age groups of the children's population in the Southern region of Kazakhstan (Shymkent, Kyzylorda). During this research period, which characterized by lack of iodic prophylaxis and mass distribution the iodine deficiency conditions among the children's population, physiological features of an organism, noted by children's age and a sex, weren't shown in a formation of a iodine deficiency.

The main source of getting of iodine in an organism is food. Food, in turn depend on existence of a state to the soil, biological features of plants and some other factors. As iodine deficiency directly depends on getting it with food, concentration of iodine easily decreases in all bodies, except thyroid gland which holds the iodine, generally containing in a colloid. Use of iodinated fertilizers can become one of the main actions providing increase of the content of iodine in plants. Importation of chlorine-containing fertilizers and acid applications of sour cespitose and podsolic soils cause reduction of getting of iodine in plants and as a result, promote strengthening iodine deficiency in soils and plants.

For definition of iodine deficiency it is necessary to know concentration of this element in an organism. The greatest concentration of iodine contains in a thyroid gland (8mg on total), in a human body contains from 20 to 50 mg. The daily need of the adult from 0,05 to 0,2 mg that completely provides an organism with iodine. Therefore, definition of iodine in blood is a control method of activity of a thyroid gland.

According to authors, concentration of iodine in blood can serve as way of control of activity of a thyroid gland, than the main exchange. At hyperfunction of a thyroid gland, the increase in iodine of blood, in particular the fraction connected with proteins is noted. At toxic hyperfunction of a thyroid gland therapy by iodine leads to reduction in blood of fraction of the iodine connected with protein whereas the fraction of free (inorganic) iodine, on the contrary, increases. Hyperthyreodizm is followed by the strengthened release of iodine with urine, excepting: pregnancy, menstrual cycle, mental excitement. According to some authors the increase in iodine in blood is noted at cholecystitises, myeloid and lymphatic leukemias, obstructive jaundice, remissions at people with malignant anemia, at some types of malignant tumors. In a question of, whether the iodine amount increases in blood at an essentsialny hypertension, the consensus isn't present.

The primary and main sources of trace elements for living organisms are natural soil and water. At the time, Vernadsky pointed out that the composition of the soil is closely related to the composition of other parts of the biosphere. Circulation of the elements in the atmosphere – Natural water – soil – plant – animal organisms is the territorial law, which may violate the presence of foci with increased content of trace elements.

Environmental contamination with heavy metals — copper, zinc, chromium, lead, mercury, cadmium and others. Is formed by emissions into the atmosphere and further subsidence in the soil cover of ferrous and non-ferrous metallurgy, thermal power, etc. The processes of smelting and processing of steel accompanied by the release into the atmosphere of manganese, lead, mercury vapor, rare metals. The emissions and open-hearth steelworks convector present dust from the metal charge, and a pair of metal oxides, prevalent of which are iron and aluminum trioxide. Non-ferrous metals are the source of atmospheric air in aluminum, copper, lead, tin, zinc, nickel and others. Metal. Out of metals in the environment comes from the combustion of fuel and fuel at thermal power plants. The coal contains all the metals of the periodic table, and especially lead, mercury, arsenic, vanadium, nickel, chromium. It was found that most of the metal is deposited in the range of 1–2 km from the source of emissions, and 10–40 % — in the range of 8–10 km from the business [1–3].

The high level of metal contaminants observed in residential areas of industrialized regions [4, 5]. Precipitation adequately reflect the air pollution in populated areas. As part of the snow in accumulative indicators reflecting the specific anthropogenic load on individual sources or industrial areas. High concentrations of toxic and potentially toxic elements found in the snow cover settlements [5, 6].

Heavy metals can exchange or non-exchange captured the different components of the soil to fall in the form of insoluble salts. Possibilities of transfer of toxicants into the slow-moving state are not the same in different soils. Distribution of heavy metals on the surface of the soil is determined by many factors. It depends on the specific sources of pollution and meteorological characteristics of the region, geochemical factors of landscape environment in general and other factors [6, 7]. Elements — toxicants, soil contaminants are concentrated in the upper (0–10 cm) layer. It has been established that 57–74 % of the lead and in anthropogenic mercury contamination fixed in the 0–10 cm layer and only 3–8 % migrate to a depth of 30–40 cm [8–10]. An important role in the accumulation of heavy metals play a secondary mineral complexes with organic matter and hydroxides of iron and aluminum. Many organic compounds are soluble or insoluble complexes with copper, and therefore the capacity of the soil to bind or containing copper in solution is largely dependent on the nature and amount of organic substances. Organic components sorb and bind zinc

in its stable shape, whereby the last accumulation is observed in the surface layers. An important role in enhancing the properties of migration of heavy metals water-soluble organic compounds play is associated with 60–90 % of migrating in the soil profile of metals [7, 11]. Understanding the processes of migration and transition elements from one medium to another is of great practical significance to study the mechanisms and pathways of human exposure, assess the toxicity of chemical elements [8, 12].

According to the observations, when the body of any one of trace elements in high concentrations change content and other trace elements. Redistribution, what is happening in the content of trace elements in the body tissues in the earliest period of receipt of any trace elements in high or low concentrations, is adaptive and protective in nature, aimed at ensuring the best performance of the tissues and organs under varying conditions. In the event that a trace element enters the body at concentrations that exceed the adaptive capacities necessary for normal functioning of the body, equilibrated relations between trace elements are broken and out of control of physiological regulation, and begins to show the action of pathogenic micronutrient. Recently established ecological conditionality of about 20 diseases occurring in the population [2, 9, 13–15].

Excessive concentrations of metals can cause serious changes in metabolism and disruption of metabolic processes, thereby reducing non-specific resistance of the organism, leads to disruption of allergic and physical status, and, consequently, to a violation of the functions of various organs and systems. Under the influence of metal damaged hematopoietic process, which in turn leads to an increase in the body immunodeficient state [10, 12, 13, 16, 17].

Under the action of toxic metals in varying degrees, suffer from circulatory, excretory, digestive, endocrine, immune, hematopoietic system. However, for all the polymorphism pattern of toxic effects for each metal is characterized by the greatest defeat of one of the above systems.

Lead in contact with the human body interacts with the sulfhydryl groups of proteins and blocking various enzyme systems. Lead is toxic to the central and peripheral nervous system, it is capable of accumulation in the body, especially in bone. Correlation method established the relationship between levels of lead and cadmium in the hair of students and their intellectual development. Lead exposure leads to the defeat of the renal tubules, accompanied by proteinuria and glucosuria. In the future, this leads to a deficiency of vitamin D and parathyroid hormone, to a violation of calcium metabolism in the body and causes the subsequent systemic bone loss — osteoporosis and osteomalacia. There is evidence that an imbalance in the body can lead to predict tumor cell growth. The excess copper leads to disruption of the blood, stimulates the development of anemia with degeneration of the liver and its complete atrophy. Since copper metabolism disorders in the body bind the early stages of malignant tumors. Zinc has no specific toxic properties, but when hit in significant quantities into the body causes dyspepsia. Inorganic cadmium compounds with prolonged inhalation and ingestion into the body, along with a general toxic causes gonadal — and embryotoxic effect [18–20].

Manganese is a neurotropic metals causes hyperplasia of the thyroid gland. There is information on the mutagenic effects of manganese and Gonadotoxic action. Pathological processes in the body due to the intake of manganese, associated with the metabolism of the latter. Manganese enters the plasma and associated with B-globulin and then distributed throughout the body. Manganese is concentrated in tissues that are rich in mitochondria, with the highest concentrations found in the liver, pancreas, kidneys and intestines. He is able to penetrate the blood-brain and placental barriers (WHO data). When studying the manganese uptake from the gastrointestinal tract it has been found that the presence of iron deficiency anemia increases the rate of absorption of manganese (Meno et al. 1969). At high levels of manganese in the body increases the rate of excretion of manganese which is accompanied by increased excretion of iron. This exacerbates the already existing interconnection anemia, thus increasing the rate of absorption of manganese (WHO data). By the end of the 80s in animal experiments shown transplacental carcinogenic substances are more than 60, and combinations thereof, belonging to different classes, including compounds of metals such as cobalt, zinc, magnesium, lead. The metal ions are capable of binding oxygen, sulfur, nitrogen, forming part of proteins and nucleic acids, and can affect the activity and correct operation of the DNA and RNA polymerases. The ability of metals to the carcinogenic effect is characterized as follows: As > Cr > Ni > Be > Pb > Cd > Hg [11, 21].

Iron deficiency anemia (IDA) — an extremely common form of clinical manifestations of iron deficiency states — to reach groups of the population is one of the first places, presenting a major challenge as the global and the national health care. According to the World Health Organization (WHO), about 2.5 billion earthlings have problems with the status of iron in the body, and the prevalence of anemia among the most vulnerable people on the planet is about 50–60 % of pregnant women and children in developing and

10–20 % — developed countries [22, 23]. IDA problems caused not only widespread, but also with serious consequences for health of vulnerable populations like young children, teenagers, pregnant women, women of childbearing age, the elderly [24]. With the presence of iron deficiency in the body are associated deterioration of mental and physical activity, reduced efficiency and productivity, increased risk of infectious diseases, impaired function of many organs and body systems. Iron deficiency in women adversely affects the course of pregnancy and labor, increases maternal and perinatal mortality, the birth of children with low birth weight. The infant is the child's psychomotor retardation, cognitive impairment and behavioral reactions irreversible backlog of mental and physical development [25].

The high prevalence of anemia in children and women of reproductive age has a negative impact on the intellectual, social and economic potential of communities and states. There is no doubt that its decision is an important condition for social and economic progress of many countries, including Kazakhstan and Central Asia. The exceptional importance of the prevention and treatment of IDA for our republic is reflected in documents such as the Declaration and Plan of Action on Nutrition in Kazakhstan and the Central Asian Republics, adopted at the International Conference of 1996, documents on national policy power in Kazakhstan [22–25].

Mutagenic effects of some metals is manifested in the prevailing impact on the genetic structures, and others — to disrupt the metabolic situation in the cells. Most obviously reproductive disorders develop in cities with developed metallurgical industry. So, the residents of the industrial center more frequently observed spontaneous abortions, stillbirths and higher [1, 11, 25]. When transplacental chemical action, in particular blastomogenic agents, the embryo may occur disorders that depend on the nature of the compound, dose, timing and exposure period. Thus, under the influence of the agent on blastomogenic 1–6 weeks after fertilization (the period of division of the zygote, implantation, organogenesis, placentation) is implemented embryotoxic effect leading to the death of the fetus and spontaneous abortion, from 2nd to 8th week (organogenesis) — teratogenny effect as malformations of the embryo (placentation periods, histogenesis, organogenesis and fetal growth) — carcinogenic effects — there are malignant tumors [22].

Thus, numerous publications and conducting independent research, found a direct linear relationship between the content of chemical elements in the environment (soil, water, air), and the incidence among the population.

The diagnosis «cretinism» is made only when there are irreversible signs in lag of development of the child; success of therapy, as we know, is higher, than it is begun earlier. In this case, definition of iodine in blood, has, according to a number of authors, important practical value as allows to establish cretinism threat in due time when other methods of research are still powerless.

This article is attempt to bring completeness and clarity of biological function of iodine, providing normal, full functioning of a human body and as statistical data, determination of concentration of iodine in biological material (blood, urine) testify, can prevent development of illnesses (a thyrotoxicosis, an endemichesky craw and some other).

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Г.Ж.Мукашева, Б.Зернке, М.А.Мукашева

Гомеостазды бір қалыпта ұстауға және ағзадағы йодтапшылықты анықтауға йодтың қатысының биологиялық жолдары жайлы

Мақалада қоршаған ортада йодтың тапшылығы адамзаттың жүздеген жылдар бойы өзгермей келе жатқан, адамзатқа төнген, ұзақ уақытқа созылған фактор болып табылады. Авторлар ағзаны йодпен қамтамасыз етуде басты рөлді атқаратын тамақтану және оның көмегімен аймақтың және әлеуметтік жағдайдың геохимиялық ерекшеліктері іске асырылады деп белгілейді. Ағзаның йодпен қамтамасыз етілуін зерттеу нәтижелері бойынша йодты профилактика жүргізілмеген жағдайда тұрғындарда жаппай йодтапшылығы байқалатыны дәлелденген. Қазақстан бойынша гигиеналық зерттеулер жүргізу кезінде барлық аймақта әр түрлі дәрежеде йодтың жетіспеушілігі анықталған.

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О путях биологического участия йода в поддержании гомеостаза и определения йододефицита в организме

Дефицит йода в окружающей среде является долговременным фактором, не меняющимся на протяжении столетий человеческого существования. Безусловно, в йодной обеспеченности организма большую роль играет питание, посредством которого реализуются геохимические особенности территории и социальные условия. Результаты многочисленных исследований йодной обеспеченностью организма свидетельствуют о том, что в условиях отсутствия йодной профилактики йододефицитные состояния населения имеют массовый характер. При проведении гигиенических исследований по Казахстану было выявлено, что практически во всех регионах в той или иной степени наблюдается йодная недостаточность.

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Drafting method of atmospheric air condition monitoring

Currently, in the existing methodological recommendations covered issues of ranging areas based on quantitative and qualitative analysis criteria, using air-route and under torch samples. In modern conditions for the control of air pollution are necessary techniques to provide an adequate assessment of the degree of air pollution with minimal physical, technical and financial costs. Evaluation of air pollution with the help of maximum permissible concentration is carried out with the mandatory condition of coincidence of their temporal characteristics with the timing of the actual pollutant concentrations in the atmospheric air. For assessing the degree of air pollution.

Key words: atmospheric air, the maximum permissible concentration, chemicals, dust, heavy metals, ecology, monitoring.

Great importance for the air protection sanitary is to identify new sources of the air pollution, taking into account projected, constructed and reconstructed facilities, polluting the atmosphere [1–3]. The Environmental Safety Concept of Kazakhstan for 2014–2015., approved by the Presidential Decree № 1241 from 03.12.2003 year, provided the requirements of the establishment of standards for industrial emissions of pollutants into the Kazakhstan environment [3]. These standards are defined so that the total emissions from all area industrial enterprises did not exceed the standards for maximum allowable concentrations of pollutants in ambient air. For each stationary source set emission limit values (ELVs) only on the basis of maximum permissible concentrations (MPC) [4–8].

Air monitoring — a multipurpose information system, which has primary goals — observation, evaluation and forecasting of air quality under the anthropogenic impact influence [5]. Many countries have set up special stations for monitoring [1, 3, 4, 6].

Comprehensive ecological assessments of the ambient air needed for comparison with each other industrial regions, however, with dozens of indicators MPC describing various adverse environmental factors. Comprehensive assessment of the industrial area air environment adverse factors, can use the classes of substances that are normally given in Tables MAC. There are: the first class of danger: benzopyrene; the second class of danger: nitrogen dioxide, hydrogen cyanide; the third class of danger: sulfur dioxide and phenol; the fourth class of danger: benzene, acetone [2]. For detailed assessment and prediction of the air state in the cities take extra: carbon monoxide, hydrogen sulfide, sulfur dioxide, formaldehyde. In addition, dust and soot are recorded [2]. For a complex environmental assessment are used bioindication methods. Plants and their advantage is that they respond immediately to the entire amount of impurities [2, 9]. Bioindication methods are cheap and require relatively little time. Sharing their use allows to improve the estimation and air quality forecast accuracy, reasonable estimate about the state of the environmental area.

There is a quite clear correlation between the proliferation of lichen degree and the sulfur dioxide concentration in the air. Lichen complete absence means that the concentration of sulfur dioxide in the air exceeds 0.3 mg/m^3 [9].

The intensive air pollution is characteristic for large and medium-sized industrial cities, where on a person at the same time affect from 30 to 100 or more harmful chemical substances in quantities exceeding the maximum permissible levels, and their combined effect is even more significant [10]. Therefore, in many European countries and the United States to ensure the monitoring of air basin created an automated system of air pollution control [11–13]. The control system includes an automatic monitoring of the industrial emissions; check of the pollutants concentrations; analysis of the received information; determination of the actual state air pollution; measuring one or more ingredients concentration of the following series: SO, CJ, NO, O, CH, HS, NH, suspended solids; determination of moisture, temperature, wind direction and speed; the adoption of measures to reduce emissions; prognosis and assessment of the pollution level; development of recommendations for environmental improvement; checking the calculations of impurities dispersion [13–15]. At the air monitoring is used high-tech electrochemical, amperometric, semiconductor, quartz crystal, photometric sensors using fiber optics and detector tubes, biosensors, sensors on the surface-active fibers, and others.

Monitoring of the atmospheric air on the industrial region territory operates with a frequency of fixing the measurements results — 3 times a day up to 60 times per hour. Air monitoring stations operate automatically, the development of the monitoring is done by increasing the number of fixed stations and mobile observation posts application. Further an observing systems improvement is carried out through the use of more modern technology, combining the individual control systems in stationary, routing, mobile (undertorch) or in a comprehensive observation posts [15–18]. Fixed post is intended for continuous pollutants registration or regular air sampling for analysis. Highlighted stationary support posts — to identify long-term changes in the content of the basic and most common contaminants [16, 17]. Routing post is intended for the regular air sampling at a fixed point of the area observations, which is carried out by using a specially equipped vehicle laboratory [16, 17]. Roll (undertorch) post is intended for sampling under the plume to identify source influence zones [17, 18]. Laboratories, mounted in the car, make observations under the torch. Undertorch posts are arranged at the certain points on a fixed distance from the source. They move according to the direction of the surveyed emission source torch. Stationary and route posts are placed at the locations selected on the basis of a preliminary air pollution study, firstly in the most contaminated areas, adjacent to the most traffic highways, and also in the recreation areas [15–17].

The most contaminated areas include the largest maximum single (Ms) areas and the average concentrations (A) produced by the enterprises industrial emissions (within a radius of 2 km from low sources and from 2 to 3 km from high). Undertorch posts are placed considering the most expected concentrations at 0.5; 12; 3; 10 km distance from the sanitary protection zone (SPZ) border or the air pollution source downwind from it. The direction of the torch is determined by visual observation of the smoke clouds contours and the wind direction, if there is no smoke cloud [15–18]. Each observation post should be placed on an open, all sides ventilated with a non-dusting floor surface (asphalt, hard ground, turf) to prevent measurement results distortion because of the green spaces presence, buildings and other facilities. The observation posts quantity is established depending on the city population, so that, up to 50 thousand residents — 1 post; up to 100 thousand — 2 post; up to 200 thousand — 2–3 post; from 200 to 500 thousand up to 5 positions; more than 500 thousand to 10 posts; more than 1 million inhabitants up to 20 stationary and routing posts. The distance between the stationary posts is from 0.5 to 5 km. The number of monitoring stations for ambient air also depends on the settlement area, the terrain, the the placement characteristics and the level of industrial enterprises development, the location of roads with heavy traffic, the recreation and resort areas location, climate-weather conditions [15–19].

The level of air pollution is estimated according the year observations. To account the fluctuations in weather conditions and to obtain more reliable information about the contamination level are used observational materials for the period of 2–5 years. The total number of observations during the period under consideration should be not less than 800. In a mandatory list of controlled substances are included: benzo(a)pyrene, soluble sulfates — in cities with a population over 100 thousand residents; formaldehyde and lead compounds — in cities with a population over 500 thousand residents; metals — in cities with ferrous and non-ferrous metallurgy manufactures; pesticides — in the cities located near agricultural areas. The list of controlled substances is reviewed at least once every 3 years. It should be pointed out, that, at the undertorch supervision is carried out monitoring of specific pollutants, which are characteristic for this enterprise emissions [18, 19].

Thus, the analysis of quantitative indicators in the air gets improved in the criteria development and methods for quantitative assessment of chemicals in the air basin, which, in our opinion, is the scientific basis for recognizing the feasibility of the air quality monitoring. However, despite the significant number of the environmental objects studies, such as ambient air, individual questions on comprehensive assessment aspects of the anthropogenic and natural factors, affecting the level of air pollution in industrial regions, is still insufficiently developed.

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Атмосфералық ауа күйінің мониторингін құрастыру әдістемесі

Бүгінгі таңда қолданыста бар әдістік ұсыныстарда территориялық орынға ие сұрақтар жарық көрді, олар ауаның сапалық және сандық талдау көрсеткіштері негізінде сапарлық және факеластылық сынамалар көмегімен жасалған. Заман шарттарына сай атмосфералық ауаның ластануын бақылау үшін, оған минималды физикалық, техникалық және қаржылық шығындарда, ауаның ластануына жеткілікті дәрежеде баға бере алатын әдістер қажет. Ауаның ластануын бағалау шекті рұқсат етілген концентрацияның көмегімен жүзеге асады, бірақ міндетті шарт негізінде оның уақытша сипаттамалары атмосфералық ауаны ластайтын заттардың фактілік концентрациясының уақытша сипаттамасымен сәйкес болуы тиіс.

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Методика составления мониторинга состояния атмосферного воздуха

В настоящее время в существующих методических рекомендациях освещены вопросы ранжирования территорий на основе количественных и качественных критериев анализа воздуха с использованием маршрутных и подфакельных проб. Отмечено, что в современных условиях для контроля загрязнения атмосферного воздуха необходимы методики, позволяющие дать адекватную оценку степени загрязнения воздуха при минимальных физических, технических и финансовых затратах. Оценка загрязнения воздушной среды с помощью предельно допустимых концентраций осуществляется при обязательном условии совпадения их временных характеристик с временными характеристиками фактических концентраций загрязняющих веществ в атмосферном воздухе.

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The problems of solid waste disposal on the territory of Karaganda region and their solutions

In the article are presented data devoted to the problems of municipal solid waste, as they are one of the most acute economic and environmental problems. In the cities, there is an intensive accumulation of solid waste and bulky waste, which, if improperly and untimely removal seriously pollute the environment. Creating a normal conditions of people lives in the city — the primary task of public utilities engaged in sanitary cleaning and cleaning of urban areas, the disposal of solid waste. Therefore, there is a need to develop new approaches in the system of waste management and the creation of modern components the relevant infrastructure in the field of solid waste management. According to the results of the literature review, the main objective is the modernization of regional waste management systems, using the best available technology to manage waste without causing unbearable cost for the user. The aim will be achieved by implementing an investment project for building in the area the waste management complex, consisting of the plant sorting and processing of waste and landfill, as well as the introduction of separate collection of waste from households and businesses.

Key words: MSW, pollution, biogas, dump.

At this stage the assessment of environmental components shows a generalized characteristic of the natural and socio-economic environment in the area of the planned activity, considered the basic directions of the economic use of the area and identified principle positions of assessment environmental impact, including:

– analysis of the production activity of the enterprise to establish the species and the scale of the potential impact;
– analysis of production activities to establish types and intensity of the impact on the environment, the spatial distribution of impact sources;
– air protection from pollution;
– protection of water resources from pollution and depletion;
– characterization of formation and distribution of the amount of waste production and consumption in the process of the planned activity;
– forecast of emergency situations and their prevention;
– environmental protection measures to reduce the anthropogenic load on the environment;
– recommended measures to minimize the impact on the above components of the environment [1–3].

Determination of the optimal solution is always a compromise between desires and opportunities, and in the particular case — between the environmental benefits and financial capabilities. These two aspects determine the need of the proposal for political leadership (akimat) and public generally three alternatives:

1) the most profitable from the economic point of view — «0» Alternatives, where everything remains as it does;

2) the best from an environmental (or the use of the best technology) point of view — the maximum recycling and minimum waste disposal;

3) basic alternative — a realistic, balanced as environmental requirements with economic opportunities, including economic and social aspects [4].

For selecting alternatives are used the following criteria: economic, environmental, technological and social components. Economic criteria should have a priority when choosing the optimal number of regional landfills which would be built. We have to apply minimum the following criteria:

– in accordance with the requirements of regulations;
– the amount of investment costs;
– operating costs;
– cost per unit of output produced goods (material);
– availability for users (their ability to pay) [4].

Justification of the choice of strategic alternatives

To determine the alternatives were developed different options for collecting and processing waste for the prediction of the formation and disposal of solid waste collected separately, sorted, processed recycled, passed back and buried at the polygon. Analysis and forecasts of the flow of solid waste form the basis for the definition of requirements to potential and volumes of different methods of collection and processing.

After analysis of alternatives it is obvious that the alternative 1 is not acceptable because does not comply to requirements of policy decisions and according to the applicable regulations. In addition, following this alternative will be continued adverse impact on such environmental components as soil, groundwater and surface water, the air. At the same time in the economic cycle will not be returned to a significant amount of recycled materials which will adversely affect the economy of the region and the country as a whole because they do not increase revenues in the budgets of all levels. Accordingly, the waste management industry will not get development and therefore does not increase the number of jobs that doesn't not allow the development of the social sector. Therefore, this alternative is not further considered.

Carried out further analysis of the alternatives can be concluded that the alternative actions allow you to have the greatest benefits from ecological aspects' point of view using technology theoretically allowing to achieve the highest level of environmental protection will be unfavorable and unacceptable in terms of both investment and operating costs. This may cause an adverse impact on the social environment as well as lead to the unwillingness of the population to use the system for solid waste management. This phenomenon, which can be caused by prohibitive costs of public services for waste management, in the final turn, may have an adverse impact on both the environment and the social environment, because the population is supposed to take the opportunity of the illegal dumping of waste into the environment.

Accordingly, the above implies that the planning of the system must be found a compromise between environmental and economic aspects of the issue. This is crucial economic factor, because the solvency of the user by the system plays a critical role in creating viable from economic point of view of the system. By the method of finding such a compromise, which would correspond to the requirements of current regulations, is to carry out financial — economic analysis.

Technical alternatives of development of the waste management system

Here it is considered an alternative to the further development of the waste management system. Choosing the best option for solid waste management system in accordance with the requirements.

Technical tasks, based on the analysis of alternatives:

– selection of the place;

– design, which depends on the choice of location and technology solutions.

When choosing alternatives are decisive legislative factors that determine the minimum necessarily followed the requirements, and also financial — economic aspect, in the end, it is crucial in assessing the possibility of implementing and operating the system. Moreover, the actual content of the system is determined by the solvency of the system user, assuming that realizing the principle «polluter pays».

Factors determining the choice of alternatives

Determination of the optimal solution is always a compromise between desires and opportunities, and in the particular case — between the environmental benefits and financial capabilities.

To select alternatives was used the following criteria — according to their order of viewing:

– geographical (location of new infrastructure);

– technological, including the use of the best available technologies;

– legislative or requirements of regulations, including determining a set of measures to protect human health and the environment;

– economically-social, which, in total, determine the system;

– administratively — political, especially in cases where is not meeting economically-social criteria [5].

The main, on condition, that we want to have a cost-effective system that is socio — economic criteria. Therefore, they are decisive in the choice of technology — both for the individual components and the system as a whole.

Deviation from this is possible only if making administrative and political decisions about grants for the creation of a system and / or subsidize its operation. However, it should be time-limited nature, since the age of unprofitable systems is short-lived.

In the European Union it is usually grants for the creation of systems. In the waste management sector, these grants are very significant — they reach 85 % of the total investment (excluding VAT, which is paid by the Client). The purpose of the grant — the alignment of differences of socio-economic conditions between «old» and «new» members of the European Union. In the specific case to achieve the purpose it is solving two objectives: ensuring compliance with regulations (mandatory) and to implement the best available technologies (where possible) [5].

To select the alternatives, taking into account the foregoing, the following basic criteria for evaluation of the proposed new system for waste management:

– in accordance with the requirements of regulations;
– the amount of investment costs;
– operating costs;
– availability for users (their ability to pay).

Geographical alternative

When creating or improving any system that requires the placement of stationary objects, almost always there are alternatives for location of the new facility. Always, in the case of development or improvement of the existing system, as the first and main alternative to consider the possibility of development of the system in place already allocated for these purposes. Of course, if the continuation of this activity is not possible on the requirements of regulations or other legitimate reasons, or is not appropriate for economic reasons, necessarily a consideration of new places, alternative that already exist.

City uses four operating landfills in the region of Karaganda, Saran, Shakhtinsk, Temirtau and Abay. In addition to these, there are many unauthorized dumps throughout the region. Here are some of them.

Proposed two alternative variants of placement, for which the connection point to sources of engineering communications and distance does not change and will not result in significant changes in the lining of networks. According to the applied reference sites on the barren and lack of groundwater. Correction of technical solutions will be implemented in the work project stage (Table 1).

Table 1

The location and size of existing storage of researching region

№	Storage	Required space/volume	The start of exploitation
1	2	3	4
1	Karaganda		
1.1	Acting polygons	10.80 hectares	1991–
1.2	Maikuduk	2.55 hectares	2004–2005
1.3	Prishahtinsk	15.80 hectares	1999–2007
1.4	Sortirovka	3.15 hectares	–2010
	st. Balkhash	200 m^3	
	st. Okhotskaya-Badina	150 m^3	
	st. per. Radio	120 m^3	
	st. Shakhanskaya	300 m^3	
	st. Crimean	600 m^3	
	st. Dzhangildin	200 m^3	
	st. Dzhangildin	150 m^3	
	st. Ternopil	260 m^3	
	st. Chaikinoi, 152	500 m^3	
	st. Bibliotechnaya, 25	3000 m^3	
	st. Chaikinoi, 157	600 m^3	
	near 85 school	150 m^3	
	st. Medical, 60,	385 m^3	
	st. Chaikinoi, 138	150 m^3	
	Md. «Vostok-5» (pit unfinished schools)	100 m^3	
	st. Chaikinoi 145	150 m^3	
	st. Medicinskaya, 1	170 m^3	
	st. Mirnaya 10	150 m^3	

1	2	3	4
	st. Ishim, 78	100 m^3	
	st. Govorov, 14, 18, 20, 22	100 m^3	
	st. Moldagulova, 89	150 m^3	
	st. M.Mametova 60	100 m^3	
	st. Carpathian, 38	100 m^3	
2	Saran	2.10 ha	1999–
3	Shakhtinsk	3.28 ha	> 40 years
	vil. Shahan		> 40 years
	vil. Novodolinka		> 40 years
	vil. Dolinka		> 40 years
4	Temirtau	49.00 ha	
	st. Temirtau, 46	50 m^3	
	pr. Miraotul. Karaganda. Highway till st. Kalinina	120 m^3	
	st. Central, 28,	70 m^3	
	117 quarter (former cinema «Stroitel», cafe «Molodezh»)	100 m^3	
5	Abay	9.51 ha	2003–
	«Abai-1»	931 m^3	2002–

Image of illegal dumps is presented in the Picture and storage in the Table 2.

Picture. Illegal dumps on the st. Radio (120 m^3)

Table 2

№	Storage	Area, ha
1	Karaganda	
1.1	The acting polygon	10.8
1.2	Maikuduk	2.55
1.3	Sortirovka	3.15
1.4	Prishahtinsk	1.58
2	Saran	2.1
3	Shakhtinsk	3.28
4	Temirtau	49
5	Abay	9.57
	Total	82.03

Even at authorized acting damps is not available facilities for capturing or burning of biogas emissions. Artificial layers for protecting of the subsoil is not installed. Some of these polygones are located in the old sumps and therefore have little natural subsoil. However, it is not known how much is enough to protect the subsoil and subsoil aquifer.

Due to the production of biogas there is a high risk of fire (for example, a fire at the Karaganda range). The fire at the polygons generates large environmental and social impacts.

Many illegal dumps across throughout region, often in residential areas leads to high environmental and social risks. At present, there is no control over the export of waste in these places. Typically, they have a high risk of fire. Fire can spread to neighboring houses. Also, the combustion of plastics produces toxic gases.

If there are an organic waste on the dump, it will attract animals such as rats, cockroaches and others. They can be passive carriers of germs on the surface of their bodies, including those that are potentially harmful to human. Sewage water penetrating into the soil, contaminating the aquifer. The wells (sumps) in the area may be contaminated and be a source of disease for people who use the water.

In addition, for children, these damps are very interesting to play. In this case, there is a risk of illness or injury, for example, by broken glass or razor blades.

For the prevention of disease and injury is absolutely necessary to clean these areas and control to avoid a new accumulation of waste in these areas.

Technological alternatives

These two aspects determine the need of the proposal for political leadership (akimat) and public generally three alternatives:

1) the most profitable from the economic point of view — «0» alternative, where everything remains as it does, but that is not acceptable from the point of view of the requirements of regulations and sustainable development of society;

2) the best from an environmental (or the use of the best technology) point of view — the maximum recycling alternative.. It involves the use only the best available technologies, but it is unfortunately not acceptable for economic reasons, since the user of the system is not able to pay for its operation;

3) trade-off between «0» alternative and «maximum» alternative — «the base.» It balanced legislative, technological and economic requirements, namely:

a. met the minimum requirements of regulations;

b. introduced, as it allows the economic factors, the best available technologies;

c. met two mandatory requirements for cost-effectiveness of the system (in the case of waste management): the «polluter pays» and user of the system is solvent.

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Қарағанды облысында қатты тұрмыстық қоқыстарды жою мәселелері және оны шешу әдістері

Мақалада қатты тұрмыстық қоқыстар (ҚТҚ) мәселесі қарастырылған, себебі ол өміріміздің, табиғатты қорғау және шаруашылықтағы өзекті мәселелерінің бірі болып отыр. Қала маңында қатты тұрмыстық қоқыстар мен көлемді қоқыстардың көптеп тасталуынан жылдам және тез жиналуына байланысты,

олардың кейбіреулерінің дұрыс және уақытында жойылмағандықтан, қоршаған табиғи ортаға көптеген зиян әкеледі. Авторлар қала тұрғындары өміріне қолайлы жағдай туғызу коммуналдық қызмет көрсетушілердің негізгі жұмысы деп түсінеді. Олар қала аймағында санитарлық тазарту жұмыстарын жүргізу барысында ҚТҚ жою жұмыстарын тікелей жүргізуге тиіс. Сондықтан бұл жүйеде жұмысқа жаңаша қарағанымыз және ҚТҚ жою саласында инфрақұрылымға сәйкес келетін заманауи компоненттер шығару қажет. Әдебиетке бейне нәтижесінде шолу жүргізу аймақтық қоқысты басқару жүйесінің модернизациясындағы басты мақсат — қоқыспен жұмыс істеу үшін қолданушыға көп шығын келтірмейтін, ең жақсы қолжетімді технологияларды пайдалану. Мақсатқа жету үшін қоқыс басқару кешенін ұйымдастыру керек, яғни, қоқыстарды реттейтін зауыт, қоқыстарды көметін жер, кәсіпорындар мен тұрғындардан қоқыстарды жеке-жеке жинау жүйесін енгізу қажет.

Я.Ю.Соколенко, А.М.Айткулов, Д.Лорант

Проблемы утилизации твердых бытовых отходов на территории Карагандинской области и способы их решения

В статье рассмотрена одна из самых острых хозяйственных и природоохранных проблем — проблема твердых бытовых отходов (ТБО). Отмечено, что интенсивное накопление твердых бытовых отходов и крупногабаритного мусора при неправильном и несвоевременном удалении серьезно загрязняет окружающую природную среду. Создание нормальных условий жизни людей в городе — первоочередная задача коммунальных служб, занятых санитарной очисткой и уборкой городских территорий, утилизацией ТБО. Назрела необходимость в разработке новых подходов в системе управления отходами и в создании современных компонентов соответствующей инфраструктуры в сфере утилизации ТБО. Главной целью проведенного авторами литературного обзора является показ модернизации региональных систем управления отходами с применением лучших доступных технологий для управления отходами, не вызывающими непосильные затраты для пользователя. Цель планируется достичь путём реализации инвестиционного проекта по созданию в данном регионе комплекса управления отходами, состоящего из завода сортировки и переработки отходов и полигона захоронения отходов, а также внедрения системы отдельного сбора отходов у населения и предприятий.

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Экологическая оценка содержания тяжелых металлов в компонентах речных экосистем горнорудных территорий Республики Башкортостан

Загрязнение водных объектов в районах с развитой промышленностью обусловлено первичной и вторичной нагрузкой, как бактериальной, так и химической, что формирует непосредственную и потенциальную опасность. Выпуск неочищенных или недостаточно очищенных сточных вод определяет первичную нагрузку на водоем, непосредственная токсическая опасность которой для здоровья обусловлена преимущественно тяжелыми металлами. Авторами приведены результаты изучения содержания тяжелых металлов (Zn, Cu и Cd) в воде, донных отложениях и фитомассе рдеста блестящего (*Potamogeton lucens* L) в зоне воздействия объектов горнопромышленного комплекса Республики Башкортостан. Показано, что вдоль градиента загрязнения наблюдается повышение уровня содержания металлов.

Ключевые слова: загрязнение, тяжелые металлы, поверхностные водоемы, донные отложения, макрофиты, рдест блестящий.

Южный Урал, где широко распространены полиметаллическое и медно-колчеданное оруденения, относится к районам естественных геохимических аномалий [1]. Освоение и разработка месторождений полезных ископаемых в Зауралье Республики Башкортостан (РБ) сопровождаются всесторонним воздействием на окружающую среду. Одними из наиболее уязвимых элементов ландшафта являются поверхностные водоемы, используемые для рыбохозяйственных целей, сельскохозяйственного водоснабжения, рекреации и хозяйственно-бытовых нужд населения [2]. Добыча и переработка руд приводят к загрязнению водных экосистем тяжелыми металлами (ТМ), поступление которых происходит в основном со сбросом неочищенных или недостаточно очищенных шахтных, рудничных и подотвальных вод [3]. Вынос гидрогенными потоками токсичных химических элементов продолжается и после завершения эксплуатации месторождений. Как отмечают Р.Ф.Абдрахманов и В.Г.Попов [4], горное производство приводит к перераспределению химических веществ в природе. При этом масштабы и интенсивность техногенных геохимических аномалий во много раз превышают параметры природных геохимических полей.

В воде в результате протекания процессов комплексообразования, коагуляции, адсорбции, изменения окислительно-восстановительных и кислотно-щелочных условий происходят трансформация поступающих химических форм металлов и образование устойчивых в данных условиях сосуществующих растворенных форм, определяющих степень токсичности того или иного металла [5].

А.Ю.Опекунов [1] отмечает, что вода обладает высокой динамичностью, которая зависит от гидрометеорологических факторов и гидродинамических характеристик. В связи с этим значение и достоверность результатов исследований, ограниченных только показателями загрязнителей в воде, снижается. Донные отложения являются консервативной системой, и поэтому результаты исследований осадков являются более информативными показателями. Для целей экологического мониторинга важным является классификация донных отложений по размеру составляющих их частиц. Как правило, с уменьшением размера фракций грунта содержание металлов в них увеличивается. Существует несколько методик определения ТМ в донных отложениях. При этом различные реагенты извлекают из пробы определенные формы металлов либо металлы, связанные с конкретными фазами грунта. Подвижные формы металлов быстрее включаются в миграционные потоки, переходя в растворенное состояние, хорошо усваиваются гидробионтами и могут трансформироваться в более токсичные соединения [5, 6].

Число трофических уровней в водной цепи питания больше, чем в наземной. Важным элементом пищевой цепи в водных экосистемах являются макрофиты. Так, водорослями и водными растениями

питается большинство гидробионтов, становящихся, в свою очередь, пищей для рыб. Макрофитами питаются и растительноядные рыбы, которые служат пищей для хищных рыб. Таким образом, тяжелые металлы, поступая в водоем, способны активно включаться в круговорот веществ и мигрировать по пищевым цепям к человеку при употреблении рыбной продукции [7, 8].

Большинство ТМ являются важными для жизни микроэлементами, однако их избыточное поступление в организм человека может приводить к нарушениям метаболизма. Обладая кумулятивными свойствами, ТМ могут проявлять мутагенные, тератогенные и канцерогенные свойства. Последние исследования показали, что связанные с поступлением микроэлементов вредные для здоровья эффекты возникают при более низких, чем предполагалось ранее, уровнях [8]. Так как здоровье человека в определенной степени зависит от факторов среды обитания, с увеличением техногенеза возрастает и актуальность санитарно-гигиенического мониторинга окружающей среды.

Целью исследований являлось изучение влияния объектов горнорудной промышленности на содержание приоритетных ТМ в компонентах речных экосистем.

Объекты и методика исследований

В течение нескольких десятилетий высокому техногенному загрязнению в регионе подвергаются реки Таналык и Карагайлы. Таналык протекает по Баймакскому и Хайбуллинскому административным районам РБ и впадает в р. Урал на территории Оренбургской области. Длина водотока составляет 225 км. В бассейне реки расположено более 10 как разрабатывающихся, так и отработанных месторождений. Карагайлы — приток р. Урал второго порядка. Длина водотока составляет 28 км. Среднее и нижнее течение реки расположено в черте пригородных поселков и промзоны г. Сибай. Карагайлы является приемником шахтных вод подземного рудника и подотвальных вод Сибайского рудного карьера. В водоохранной зоне реки находятся старое и новое хвостохранилища Сибайской обогатительной фабрики. За пределами города р. Карагайлы впадает в р. Туяляс (Худолаз).

На р. Таналык были исследованы 2 участка:

– в районе загрязнения верхнего течения реки подотвальными водами отработанного серно-колчеданного месторождения Куль-Юрт-Тау, эксплуатировавшегося в 1932–1986 гг. (участок А);
– в районе загрязнения среднего течения реки подотвальными водами Бурибайского медно-колчеданного месторождения и фильтратом хвостохранилищ Бурибаевского горно-обогатительного комбината (ГОК), работающего с 1937 г. (участок Б).

На каждом участке были отобраны пробы воды, донных отложений и растительных образцов. Пробы отбирали выше места впадения стоков (условный контроль), в месте впадения и перемешивания стоков с речной водой и на расстоянии 3 км ниже по течению от места впадения стоков (для оценки самоочищающейся способности водотока).

На р. Карагайлы (участок В) пробы отбирали в верхнем течении реки, не загрязняемом бытовыми и промышленными стоками (условный контроль), в промзоне г. Сибай и за пределами города, в устье реки.

Для изучения накопления ТМ макрофитами был выбран рдест блестящий (*Potamogeton lucens* L.), который является укореняющимся, погруженным в воду растением, обладает способностью развивать высокую биомассу побегов и служит пищей для гидробионтов. Одновременно с растительными образцами с глубины 0–20 см отбирали донные отложения, которые впоследствии анализировались на содержание подвижных форм тяжелых металлов, извлекаемых ацетатно-аммонийным буфером с pH 4,8. Измерения массовых концентраций цинка, меди и кадмия проводились методом инверсионной вольтамперометрии на приборе СТА. Полученные данные были подвергнуты однофакторному дисперсионному анализу.

Результаты и их обсуждение

В целом для створов характерен следующий убывающий ряд металлов в речных компонентах: Zn > Cu > Cd. Лишь в донных отложениях на участке Б содержание меди больше, чем цинка (табл.).

Сравнение полученных данных с предельно допустимыми концентрациями (ПДК) химических веществ в воде водных объектов хозяйственно-питьевого и культурно-бытового водопользования [9] показало, что на участке А превышения нормативов не наблюдается. На участке Б содержание цинка и меди было в пределах нормы, в то время как содержание кадмия превышало ПДК от 5 до 22 раз. В устье р. Карагайлы и в промзоне г. Сибай показатели кадмия в воде выше норматива от 8 до 12 раз. Концентрация цинка в промзоне г. Сибай достигает 6 ПДК.

Таблица

Содержание тяжелых металлов в воде и донных отложениях на участках (X±Sx)

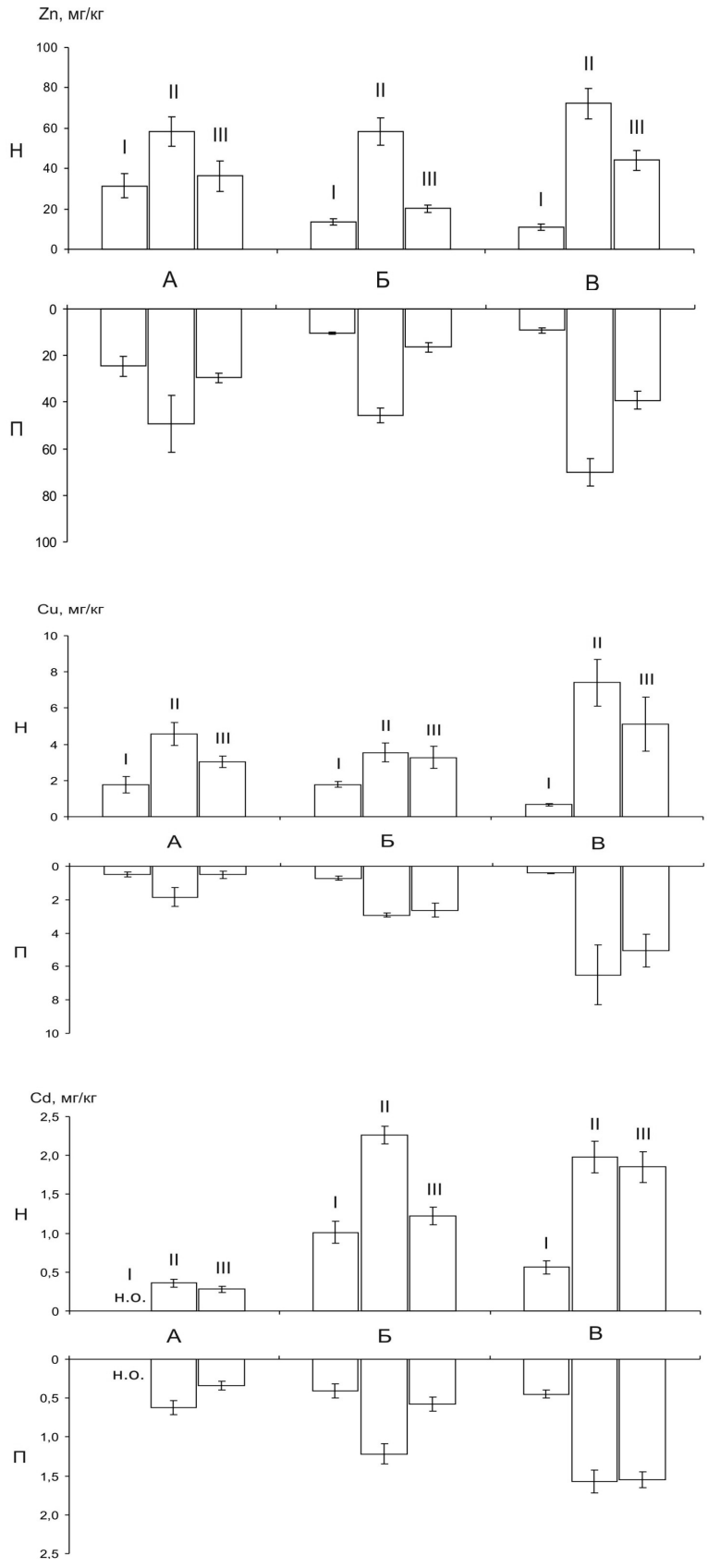
ТМ	Выше впадения стоков	Место впадения стоков	Ниже впадения стоков
Участок А			
Zn	0,03±0,01 3,70±0,43	0,14±0,02 12,97±2,06	0,10±0,02 8,19±0,67
Cu	0,014±0,002 0,84±0,07	0,030±0,006 3,10±0,08	0,020±0,004 1,62±0,07
Cd	н.о 0,005±0,0004	0,0001 0,02±0,0035	0,0001 0,03±0,003
Участок Б			
Zn	0,02±0,004 0,93±0,12	0,60±0,036 11,38±2,28	0,24±0,022 4,39±0,34
Cu	0,002±0,0002 2,70±0,24	0,090±0,0038 26,22±4,84	0,080±0,0032 22,34±3,33
Cd	0,005±0,0002 0,0002±0,00004	0,022±0,0034 0,0802±0,0054	0,021±0,0028 0,0005±0,0001
Участок В			
Zn	0,08±0,01 4,26±1,49	6,32±0,77 1,26±0,29	0,12±0,02 5,84±1,02
Cu	0,004±0,001 0,60±0,18	0,005±0,001 0,38±0,08	0,007±0,001 2,92±0,21
Cd	0,0007±0,0001 0,01±0,002	0,012±0,001 0,008±0,002	0,008±0,001 0,13±0,01

Примечание. В числителе — в воде, мг/дм^3, в знаменателе — в донных отложениях, мг/кг; н.о. — не обнаружено.

Сопоставление показателей ТМ с нормативами для водоемов рыбохозяйственного значения [10] показало, что уровень цинка и меди во всех точках отбора превышает ПДК: от 2 до 60 раз по цинку и от 2 до 90 раз по меди. Экстремально высокие показатели цинка в воде р. Карагайлы в черте г. Сибай — до 632 ПДК. Повышенные концентрации данных металлов в контрольных створах участков А и В, вероятно, связаны с особенностями естественного геохимического фона региона, а на участке Б — с фоновым загрязнением, так как выше п. Бурибай вдоль р. Таналык расположен ряд действующих и отработанных месторождений. Показатели кадмия в воде во всех створах участка А и в фоновых створах участков Б и В в пределах нормы. В районе загрязнения реки промышленными объектами Бурибаевского ГОК наблюдается превышение ПДК до 4 раз, в промзоне г. Сибай — до 2,5 раза.

Так как в Российской Федерации норматива по содержанию ТМ в донных отложениях не имеется, для оценки уровня загрязненности грунтов часто используют сравнение полученных массовых концентраций ТМ со значением величин кларка, фоновыми концентрациями или официально установленными допустимыми уровнями. Мы руководствовались перечнем ПДК для почв [11]. Содержание подвижных форм цинка в грунте исследованных участков не превышало ПДК. В районе Бурибаевского месторождения в донных отложениях концентрация меди была на уровне 7–9 ПДК. Следует отметить, что на участках, где производился отбор проб, грунт представлял собой илисто-песчаную массу. Невысокое накопление тяжелых металлов, видимо, связано с низкой поглотительной способностью песчаной фракции.

Химический состав растений отражает элементный состав среды роста [12]. В укореняющихся макрофитах уровень концентрации металлов зависит от их содержания в воде и донных отложениях, а также степени доступности растениям и физиологической роли элемента. Однофакторный дисперсионный анализ подтвердил достоверность влияния степени загрязнения на накопление цинка, меди и кадмия рдестом блестящим (рис.). Так, содержание цинка и меди в надземной и подземной фитомассе рдеста по сравнению с контролем повышается до 2 раз на участке А и до 4 раз на участке Б. На участке В концентрация цинка повышается до 7 раз, меди — до 16 раз, кадмия — до 3,5 раза. В растительных образцах с контрольной точки участка А кадмия не обнаружено, во всех других точках его содержание в корнях варьирует от 0,34 мг/кг до 1,57 мг/кг, в надземных органах — от 0,28 мг/кг до 2,26 мг/кг воздушно-сухого веса.



А, Б, В — участки; I — условный контроль;
II — место впадения загрязненных стоков; III — ниже впадения загрязненных стоков;
Н — в надземной фитомассе; П — в подземной фитомассе; н.о. — не обнаружено

Рис. Содержание тяжелых металлов в фитомассе рдеста блестящего на участках

Створы, расположенные ниже по течению от места впадения загрязненных притоков, позволяют оценить самоочищающуюся способность рек. Как видно из полученных данных, р. Карагайлы не успевает очиститься до впадения в р. Туяляс, а на участках р. Таналык содержание ТМ в воде и донных отложениях снижается, хотя и не достигает уровня контроля. Самоочищение водоемов происходит в результате химического преобразования токсичных веществ и осаждения. Значительную роль играют заросли макрофитов, являющихся аккумуляторами макро- и микроэлементов. С другой стороны, выступающие в роли депонирующей среды донные отложения и водные растения при определенных условиях могут стать источниками вторичного загрязнения воды. Следует учитывать, что продолжающееся поступление токсикантов со стоками может привести к утрате водным объектом способности к самоочищению.

Таким образом, проведенные исследования показывают, что объекты горнопромышленного комплекса являются источниками загрязнения поверхностных водоемов тяжелыми металлами. При этом экологическая ситуация осложняется наложением техногенного загрязнения металлами на общий повышенный геохимический фон их содержания в окружающей среде, обусловленный рудной минерализацией. Выявленные превышения нормативов как для водных объектов рыбохозяйственного значения, так и хозяйственно-питьевого и культурно-бытового водопользования свидетельствуют о потенциальной опасности водоемов состоянию здоровья населения региона.

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Башқұртстан Республикасының таулы территориясындағы өзен экожүйелерінің компоненттері құрамындағы ауыр металдар мөлшерінің экологиялық бағасы

Мақалада өндірісі дамыған аймақтардағы су нысандарының ластануы бірінші және екінші ретті бактериалдық және химиялық жүктемелерге байланысты, олар суқоймалардың тікелей және жанама қауіптіліктерін қалыптастырады. Тазаланбаған және жеткіліксіз тазаланған ағын суларды шығару су қоймасына бірінші ретті жүктемені анықтайды, олардың құрамындағы ауыр металдар денсаулыққа

тікелей улы қауіптілік туғызады. Башқұртстан Республикасының тау-кен өндіріс кешендері объектілерінің әсерінен ластанған судың, тұнбалардың және жылтыр рдест фитомассасының (*Potamogeton lucens* L.) құрамындағы ауыр металдарды (Zn, Cu және Cd) зерттеу нәтижелері қарастырылған. Ластану градиенті бойынша құрамындағы металдардың деңгейі жоғары екені көрсетілген.

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Ecological evaluation of the content heavy metals in river ecosystem components of mining territory Republic of Bashkortostan

Pollution of water bodies in areas with developed industry due to primary and secondary load, both bacterial and chemical that generates immediate and potentially danger for reservoirs. The issue of untreated or inadequately treated sewage detects the primary load on the pond, direct toxic hazards to health caused mainly by heavy metals. The results of the study of heavy metals (Zn, Cu and Cd) in water, sediments and biomass of *Potamogeton lucens* L. in the zone of influence of objects of the mining complex of Bashkortostan. It is shown that the contamination occurs along the gradient of increasing levels of metals.

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Prospects, opportunities and challenges of the transition to 12-year education system in Kazakhstan

The article deals with the transition to 12-year education which is a justified step. Since the negative factors affecting the development of the national pre-school models — old system of evaluation of educational achievements are not able to stimulate students led the transition of the education system of Kazakhstan to world standards. In turn, the 12-year-old system of education makes it possible to take into account more fully the interests, needs and capabilities of participants in the educational process and to more efficiently reallocate training material on curricula.

Key words: 12-year education, the education system reform, teaching material development, individual abilities.

The main task of modernizing the educational system of the Republic of Kazakhstan is to provide modern quality education and to bring all the components of the education system in line with current and future needs of the individual, society and state.

In a world on the path of globalization, the ability to quickly adapt to the competitive environment is becoming a major factor of sustainable development. Competitive ability of any developed country associated with the development of its social capital, which is largely determined by the state of the education system.

Reform of the education system, conducted in Kazakhstan, affecting all levels of education, however, the greatest transformation expect senior level secondary school. Modernization of the structure of secondary education is aimed at implementing a 12-year school-based socialization of students with the needs of the labor market, to perfect a flexible relationship with the school institutions of vocational education. This is what determines the competitiveness and sustainable development of Kazakhstan in the XXI century. It was repeatedly said by President Nursultan Nazarbayev. «Enough of us to import education», — said in one of his speeches, the Nation leader noted that we should set a goal aimed at improving Kazakhstan's education to international standards. In addition, it should be noted that in the present conditions are greatly increased requirements for scientific, technological and humanitarian training of young people, which in the future is destined to strengthen the country's position on the world stage [1].

In his message to the people of Kazakhstan «Strategy» Kazakhstan-2050» — a new policy established state» Leader of the Nation N.A.Nazarbayev stressed: «In order to become a developed competitive state, we have to be highly educated nation.In today's world it is not enough to have simple universal literacy. Our citizens must be prepared to continuously acquire the necessary skills to work in the most advanced equipment and the most modern production. It is also necessary to pay great attention to functional literacy of our children, in general, all of the younger generation. It is important that our children have been adapted to modern life».

Going national education system to world standards — a vital topic for parents and teachers. It is no secret that innovation should wear thoughtful character, and the reforms in such a sensitive field — consistently implemented.

At present, significantly increased demands on the quality of training of graduates of educational institutions, which is reflected primarily in their ability to self-consciously make choices and future professional activities, actively involved in solving problems of social and economic development of the country. In connection with this problem actualized improving the educational process in upper secondary school. Its effective solution is primarily due to the construction of educational content based on wide profile differentiation, allowing more responsive to the interests and abilities of students and the needs of society and the state in the formation of socially active and creative personality of a citizen [2].

Go to the 12-year-old school is highlighted in the State program of education development in Kazakhstan for 2011–2020 as one of the priorities of the entire education system of Kazakhstan. This is one of the

key elements of changes in the whole educational sector of the country, which together with other substantial reforms will raise Kazakhstan's education to a new level [3].

According to the Law of the Republic of Kazakhstan «On Education», the State Program for Education Development of the Republic of Kazakhstan for 2011–2020, the structure of the 12-year education includes the following levels (stages) of education:

– primary education (grades 1–4), which ensures the formation of the child's personality, his positive motivation for cognitive processes, the development of their individual abilities and skills in training activities;
– basic secondary education (grades 5–10), which ensures the development of the basic foundations of science, the formation of students' high moral and spiritual culture and the culture of interpersonal, inter-ethnic communication, self-identity and preprofile preparation;
– general secondary education (grades 11–12), providing studying the development of an integrated complete system of knowledge about nature, society and man, the creation of conditions for further intellectual, spiritual, physical growth and development of the individual, the choice for future profession on the basis of differentiation, integration and profiling of content education [4].

Going on 12 years of schooling requires a preliminary study of the basic principles and approaches to the teaching of natural sciences; understanding of the goals of learning the subject, the time sequence of the study of educational material; subject teaching content development, required regulatory documents, in particular, the concept of natural science education 12-year school [5].

The objectives of science education Kazakh school legislation by the Law of the Republic of Kazakhstan «On Education», which states that education should be directed: to ensure the self-determination of the individual, creating conditions for its self-realization; the development of civil society; to strengthen and improve the rule of law. Science education as an integral part of the overall primary and secondary education contributes to the achievement of the overall objectives of the school, providing students mastering the basics of academic disciplines, the development of their mental and creative abilities, forming the scientific worldview. Formation of natural-scientific picture of the world is achieved, provided that the study of natural sciences is primarily a means of ensuring the development of cognitive abilities of the person, expansion of its intellectual capacity, familiarity with that part of human culture, which largely determines the face of modern civilization [6].

Based on the foregoing, the goal of education can be summarized as follows: the formation of a fully developed personality; the development of personal qualities that promote self-identity, creating conditions for its self-actualization, willingness to improve, continuing education, civil society development, strengthening and improving the rule of law; mastering the basics of academic disciplines of educational area «science» of pre-school educational program; study of the main components of natural-scientific picture of the world; the understanding of basic concepts of the scientific method of scientific knowledge and its place in the educational system; development of cognitive interests, intellectual and creative abilities.

Achieving these objectives should be carried out taking into account the age characteristics of students. Each of the defined goals and detail revealed in the subsequent stages of development of normative and methodical documentation of training.

The aims of education are implemented in a particular educational process on the basis of certain didactic principles, forming a system peculiar selection rules for the structure of science education and the selection of the content of educational material. The main didactic principles governing science education, include the following principles: fundamental, availability, scientific, continuity, integrity and consistency.

The principles of education, learning objectives, providing for the formation of multiple personality of the child, the maximum disclosure of its creative potential, allow us to make very specific conclusions about the structure and content of educational programs 12-year-old school [7].

In accordance with the principle of continuity of education study subjects in the 12-year school should be carried out throughout the 12 years of training in the form of three concenters: at propedeutics in elementary school, systematic, basic school, differentiated, high school, and in high school they The study was conducted taking into account the individual interests of students.

In the first stage, propaedeutic, primary school pupils are introduced to the basic phenomena of the world, studying the course «The world around us». Then, in the first two classes of the primary school (grades 5–6), continued their acquaintance with the basic natural science and natural phenomena such basic techniques of the scientific method as observations, description of what he saw, perform measurements reveal patterns, conducting experiments and predict outcomes [8]. Achieving these goals is possible in the

framework of the integrated course «Natural» and with courses that provide a preliminary substantive specialization in physics, chemistry or biology, where the initial research techniques and skills are formed at the school for an example of science. In the second phase of 7–10 class of primary school it is advisable to study the systematic courses in physics, chemistry, biology, geography compulsory for all students. In the third stage, According to the «Law on Education» in high school, in grades 11 and 12 are studied differentiated courses in physics, chemistry, biology, astronomy, depending on the profile of education (humanitarian, technological, natural sciences and mathematics), selected students and their parents [9].

The transition to 12-year education is a justified step. Since the negative factors affecting the development of the national pre-school models — old system of evaluation of educational achievements are not able to stimulate students led the transition of the education system of Kazakhstan to world standards [10]. Furthermore, under the previous model, there is a lack of personal development, civic and moral qualities of the younger generation, the low level of awareness of their own interests and perspectives.

In turn, the 12-year-old system of education makes it possible to more fully take into account the interests, needs and capabilities of participants in the educational process, as well as more efficiently reallocate training material on curricula. At the same time there are opportunities to create favorable conditions for individual learning.

The introduction of international standards of education will enable Kazakhstan to achieve a number of objectives. First, limit and subsequently reduce available now increase the technological gap with developed countries. Secondly, it will contribute to a comprehensive quality training of graduates. Finally, it provides students with additional opportunities to select individual educational program. Thus will be laid the foundation of becoming competitive person. At the same time, the increase in the period of schooling contributes to the level of general education. It is based on the comprehensive development of the individual [11].

In connection with the transition to 12-year schooling it is necessary to review the content of quality education, school subjects and time spent on their development. In addition, it is necessary to implement a set of measures aimed at upgrading the training facilities of schools, as well as training of the teaching staff. For these purposes MES has developed the concept of a 12-year secondary education in the Republic of Kazakhstan.

According to the approved concept, the 12-year secondary education will contribute to a competitive personality, ready not only to live in a changing social and economic conditions, but also to actively influence the existing reality, changing it for the better.

We welcome the concept, but all training should be ahead of child development or to keep up with him.

Most alarming is the weakness of the mental and physical health of children today. It was found that for almost six years more than half of children have immature psychomotor, emotional and volitional instability, decreased performance, social immaturity, anxiety and aggression. In this regard, for further modernization of education necessary to develop strategic verified and scientifically based directions the organization of all parts of education. Research should be integrated with the participation of psychologists, psychoneurologists, educators, sociologists. Perhaps a certain category can be trained in six-year remedial classes. Unfortunately, it is increasing the number of children with both severe and mild mental and physical disabilities. It is this category of persons should be of special concern, since in terms of attitude towards them has always regarded the level of civilization of the state. Differential diagnosis, forms, methods and content of education, social and labor training, psychological support, employment — this is not an exhaustive list of issues regarding correctional (special) preschool and school institutions of Kazakhstan.

Against the background of environmental and social disadvantage, as well as an intensification of schooling, there is the increasing deterioration of the health of children. This problem is exacerbated in the transition to 12-year education. Most of the children in terms of developmental needs, come to school even in 7 years is not enough ready to learn. School overload that acquire systematic character, are the cause of poor progress or achievement in training gets the price of children's health. Prolonged exposure to these situations cause different behavioral and neuro-psychiatric disorders younger students. What is the way out of this impasse, of this problem of social character and is incredibly growing like a snowball, in anticipation of the transition to 12-year education. Scholars and practitioners need to actively seek effective ways of scientific research protects, gentle children's health, educational technologies. Because the human mind is based on the neurophysiological functioning, it is necessary to pay close attention to these aspects. It is known that the most energy-intensive function at this age is beforehand. That is almost half of the first grade is reduced. Suffer properties such attention as volume, shifting, stability, concentration and fluctuation of attention is a negative factor for kids. Even children with highly motivated school found these features. One of the most common childhood problems is the decline in their performance.

The way out of this situation is to prevent violations of psychosomatic health of students, the foundation, which is the correct dosage of educational tasks and ensuring proper rest [12].

Conclusion

As a result, Kazakhstan's transition to 12-year schooling will allow to successfully solve the strategic task — to create a new national model of education that can compete with the best foreign analogues.»Enough of us to import education», — said in one of his speeches, the Nation leader noted that in the future will aim to raise the level of the Kazakh education to international standards.

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Қазақстанда 12 жылдық білім берудің болашағы, мүмкіндіктері мен оған көшу мәселелері

Мақалада 12 жылдық білім беру жүйесіне көшу туралы мәселе қарастырылған, осы жүйеге көшу нақты қадам болып табылады. 12 жылдық білім беру жүйесінің мүмкіндіктері бәсекеге қабілетті және құзыретті, шығармашыл, білімді тұлғаны дамытып және қалыптастыралатын Қазақстанды әлемдік стандарттарға шығаратын жүйе болып есептеледі. Өз кезегінде авторлар 12 жылдық жалпы білім беру жеке тұлғаны жан-жақты қалыптастырудағы жаңа жүйесімен білім мен тәрбиенің ең тиімді мүмкіндіктерін, жолдарын зерттеп, оны ұтымды түрде білім беруге енгізу көкейкесті мәселеге айналып отырғандығын сөз етеді.

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Перспективы, возможности и проблемы перехода на 12-летнее образование в Казахстане

В статье рассмотрен переход на 12-летнее образование, которое является оправданным шагом. Отмечено, что негативные факторы, влияющие на развитие отечественной школьной модели, — устаревшая система оценки учебных достижений, не способная стимулировать учащихся, — обусловили переход системы образования Казахстана на мировые стандарты. В свою очередь, подчеркивают авторы, 12-летняя система обучения дает возможность более полно учесть интересы, потребности и возможности участников образовательного процесса и более рационально перераспределить учебный материал по ступеням обучения.

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The impact of the process of producing chrysotile-asbestos on environment

The process of coming fibres into organisms' of people and animals it appears to be very interesting to investigate biological, especially carcinogenic features of chrysotile-asbestos. A wide specter was found on dusty remnants of snow samples. On samples that were taken after energy dispersal analysis there were identified 11 heavy metals. Congestion rate of snow cover and heavy metals were discovered. It became known that the compound of water changes during the chemical compound analysis of melted snow and the dusty basis of snow. During winter time a wide specter of heavy metals gather in an enough amount, but basic contaminating metals are elements Si, Fe, In, Al.

Key words: chrysotile-asbestos, environment, snow sample, soil sample, heavy metals, atomic-absorbing spectrometry, inversional voltampere method.

Urbanization and growth of industrialization by means of revival of natural and technological processes lead to changes in environment. It is mostly seen in places like producing minerals in mining places, near recycling complexes, particularly at places where digging, recycling and placing of a reasonable amount of rock take place and not mining but raw materials appear.

Asbestos is a mineral that is being investigated widely according to issues covering the impact of it on human organism and environment [1, 2].

Chrysotile-asbestos as other solid parts makes up a dispersal system together with surrounding liquids being in close relations with environment. Therefore, near a fiber two electrical layers formulate that are the result of contacting phase relations [3, 4]. Thus, it is an environment where there dispersal phases formulating fiber particles and atmospheric depositions where fibers gather or as water of natural resources animals and human organisms can participate. Including chrysotile-asbestos mineral together with earth's soil undergo erosion, change and become a part of water, precipitation and soil. Existence of chrysotile-asbestos and its concentration are identified in water, air and other parts of Earth's soil [5, 6].

Like other serpentine minerals chrysotile-asbestos experience chemical degradation on the ground. This soil leads to deep changes of Ph and introduces a range of metals to environment. In its turn this plant affects negatively on growth of fish and invertebrates. In some sources when grazers (sheep and cattle) eat grass grown up with serpentine things, in cattle's blood compound there are noticeable some biochemical changes [7, 8].

The process of coming fibres into organisms' of people and animals it appears to be very interesting to investigate ecological, especially carcinogenic features of chrysotile-asbestos.

Thus, all the types of asbestos have not only fibrogenic but also carcinogenic peculiarities. Oncological deceases in organism appearing because of asbestos are known, particularly there are some dangerous ones like lung tumor, pneumonia and stomach Mesothelioma.

It is vitally important to estimate ecological danger of chrysotile-asbestos and prohibit usage of it or to decide to continue using it [9, 10].

The aim of the work is to investigate the ecological impact of chrysotile-asbestos on environment.

Investigation objectives:

1. To investigate the impact of chrysotile-asbestos production process on ecological issues.
2. To evaluate the dust remnants through snow and soil samples near industry enterprises.

Investigation materials

With an intention to assess the texnogenny pollution level there were taken some samples in order to identify the micro-elemental compounds of snow. In the middle of November before melting of the snow samples are taken in order to find out the amount of gathered polluted things. In order to prevent texnogennical impact, especially from vehicles, the snow is taken 100 meters away from the road, far from trees, hills, roofs, buildings, electrical wires, local atmosphere contaminating sources, flat lands.

Snow samples are cut using the plastic tubules that volumes are 55 cm². Samples are cut from rents as rocks with 40 cm longitude. Taken snow samples are put in covered glass dishes and melted in room temperature.

With the help of prairie emission MIRA 3LMU (Tescan, Check Republic) СЭМ microstructure of samples were investigated. Accelerated tension of electronic instrument comprised 10–30 kV. Measuring of volumes of constructed constructions was made by using analyzer of ZetasizerNano ZS (Malvern-InstrumentsLtd, Great Britain) submicronic particles.

Investigation Results

During investigation of chemical permanence, physical-chemical features, construction of fibres, that are influenced by chemical factors, also environment factors, showed that they experience changes.It influenced to some extend on the ecological change of it. According to the results of chemical permanence of chrysotile-asbestos in Zhitikara there are some changes in two synthetic types of it, acid permanence of taken samples is equal to 43,05; 44,34; 45,13 mass percent, alkali permanence is 95,37; 98,27; 96,35 mass percent. Taken materials are not stable for acid, but are endurable for high acid permanence. Due to atomic-absorbing spectrometry method chrysotile-asbestos from soil and water composing element magnesium was found out.

Soil samples were taken from the land 500 metersaway from manufacture, 1 kilometer away from sanitary zone chrysotile-asbestos in soil got from 500 meter far is equal to 1,3 g/кg, 1 km far land is 1,7 g/kg and from sanitary zone — 0,47 g/кg. At these distances the decrease of structure composing element magnesium is noticeable (Fig. 1).

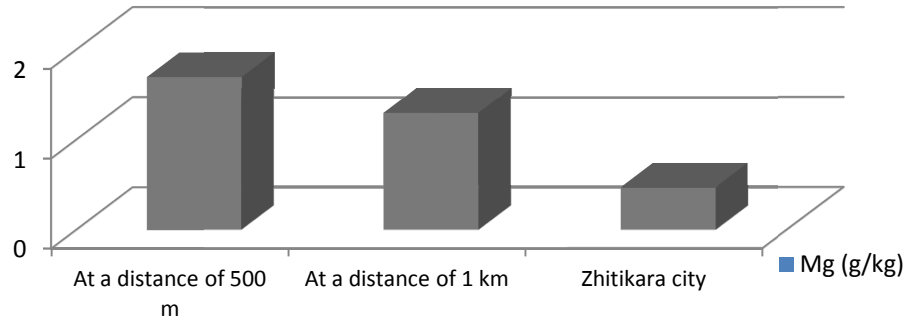

Figure 1. Amount of magnesium in soil by atomic-absorbing spectrometry method

Water samples were taken from the river Shortandi, rain (dweilling-house) and snow (dweilling-house). In water chrysotile-asbestos composing element magnesium — in Shortandi was 45,5 mg/l, rain water — 4,2 mg/l, snow water — 0,45 mg/l. At these zone starting from production till the sanitary zone the decrease of structure composing element magnesium is noticeable (Fig. 2).

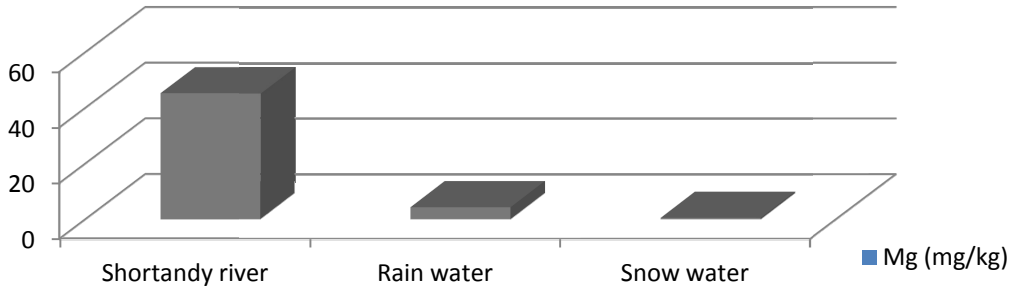

Figure 2. Amount of magnesium in water by atomic-absorbing spectrometry method

By the inversional ampere-voltmeter method the amount of heavy metals (Pb, Cd, Cu and Zn) in soil samples in given area were identified (Fig. 3).

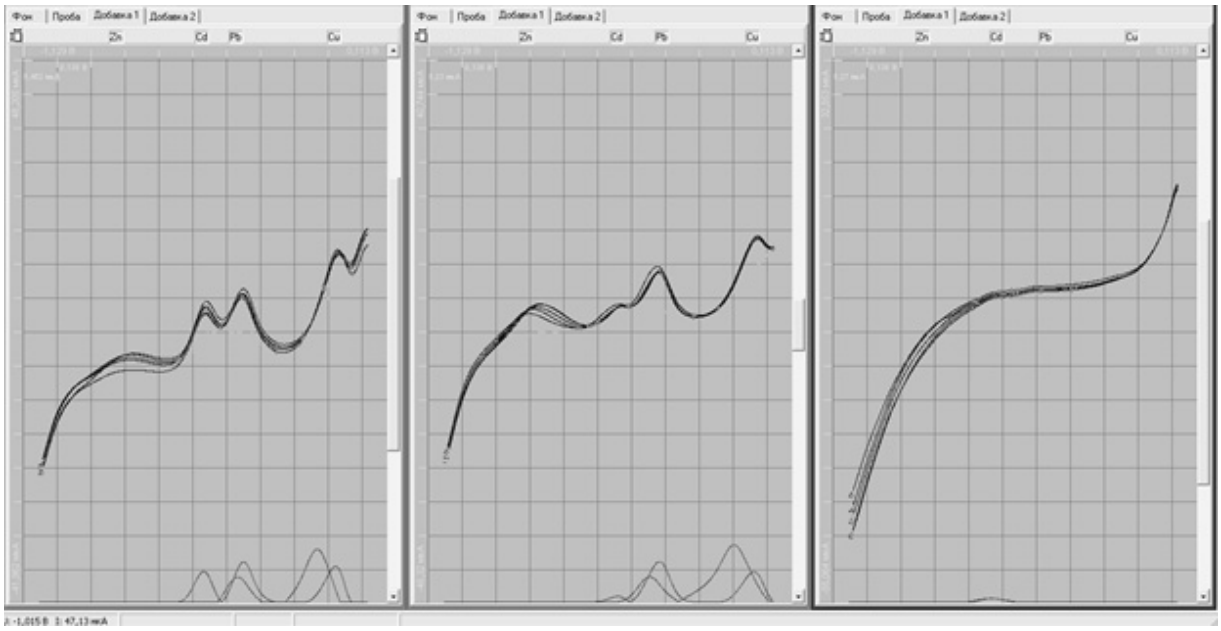

Figure 3. The amount of heavy metals (Pb, Cd, Cu and Zn) in soil samples
by the inversional ampere-voltmeter method (The view of mixture)

In compounds of soil samples taken from Zhitikara city territory amount of plumbum (Pb) 6,5±2,3 (mg/кg) and zinc (Zn) 10,0±4,6 (mg/кg) were the highest among all heavy metals.

Accumulation of heavy metals in dusty and melted snow water
nearby manufacture enterprises and their danger

The volume of particles in melted water is discovered by laser dynamic shining method.Volume measuring process of the particles was done by molecular order. For every sample three-time measurement was completed during 30 seconds. According to the shown experimental materials average volume of measured particles in snow water comprised 342 nm. Final results showed that dispersion of measured particles can range from200 nm till 400 nm. The volume of measured particles in taken melted water is shown on Figure 4.

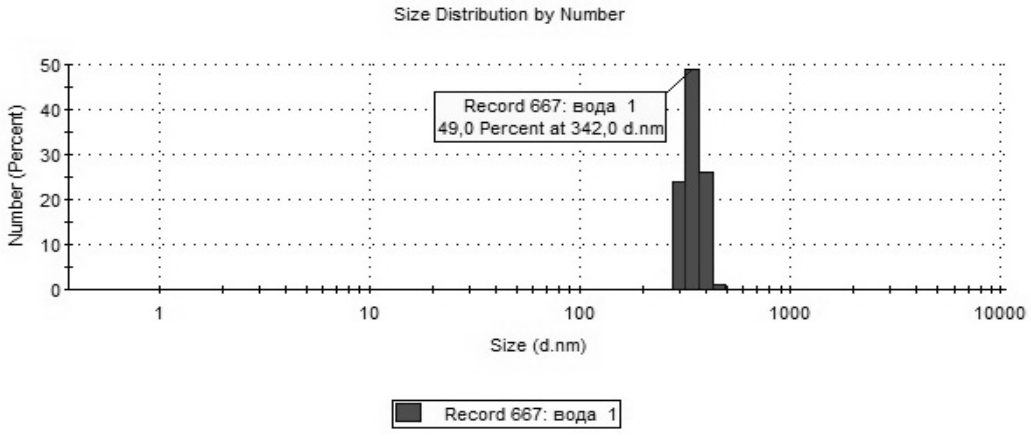

Figure 4. The volume of measured particles in taken melted water

Element compound of measured particles is illustrated in Figure 5. Wide specter of heavy metals in dust remnants of snow samples was found. 11 heavy metals were identified in investigated forms taken from energy dispersal analysis.

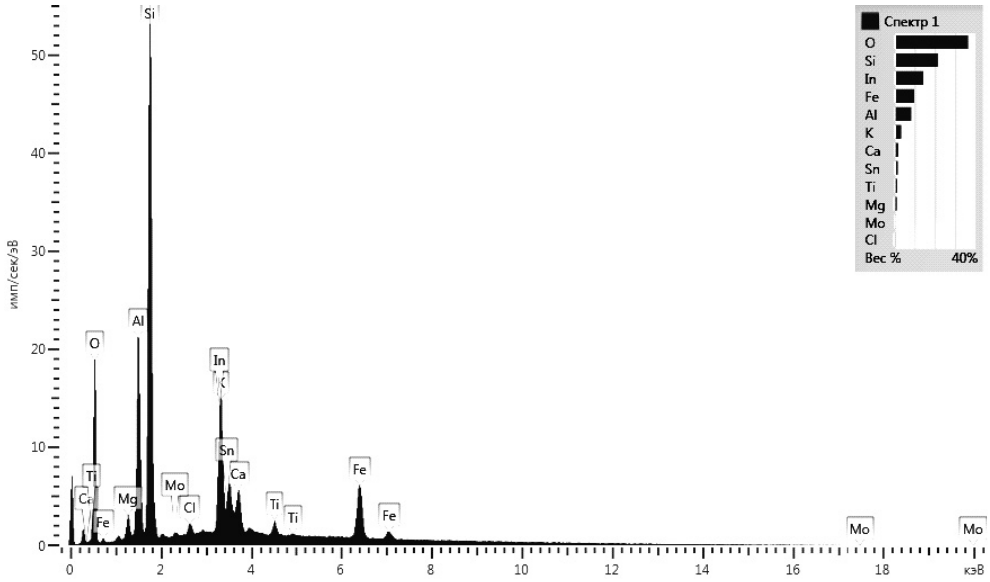

Figure 5. Results of measuring chemical elements' compounds
and percent of atom on the weight of measured particles

Analysing chemical compounds of melted snow water and dusty snow influences on renewal of water compounds in spoilt anthropogenic conditions. In winter a wide specter of heavy metals is accumulated enough, but main polluting metals are Si, Fe, In, Al elements. In such regions if chemical elements in most cases go into the organism of people the danger of prolonged intoxicationheightens.

Conclusion

1. There is a negative impact of cultivating manufacture of chrysotile-asbestos on ecological objects.

2. While analysing chemical compounds of melted snow water and dusty snow changes were noticeable in water compounds because of spoilt anthropogenic factors.. In winter a wide specter of heavy metals is accumulated enough, but main polluting metals are Si, Fe, In, Al elements.

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Хризотил-асбестті өңдеу өндірісінің қоршаған ортаға әсері

Мақалада талшықтардың адам және жануарлар ағзасына түсу барысында хризотил-асбесттің биологиялық, оның ішінде канцерогендік ерекшеліктерін анықтайтын қасиеттерін зерттеу үлкен қызығушылық тудырады. Қар сынамаларының шаңды қалдықтарында ауыр металдардың кең спектрі табылды. Энергия дисперсиялы талдаудан алынған үлгілерінде 11 ауыр металдар идентификацияланды. Қар жамылғысындағы ауыр металдардың және шаңның жинақталу қарқыны анықталды. Еріген қарлы судың және оның шаңды негізінің химиялық құрамын талдауы кезінде бұзылған антропогендік әсерден судың құрамы өзгеретіні байқалды. Авторлар қыс кезінде қарда ауыр металдардың кең спектрі жеткілікті жинақталды, бірақ негізгі ластағыш металдар Si, Fe, In және Al элементтері болып табылды деген қорытындыға келді.

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Влияние производства хризотил-асбеста на окружающую среду

В статье показано, что влияние хризотил-асбеста на организм человека и животных, а также определение его биологических и канцерогенных свойств представляет большой интерес. Выявлено, что воздействие определенных факторов окружающей среды и промышленного производства на волокна хризотил-асбеста приводит к изменению их химического состава. Авторы отмечают, что в образцах пыли были найдены в широком диапазоне тяжелые металлы, в составе снега был определен суммарный состав тяжелых металлов и пыли. Во время анализа химического состава основания снега, талой воды и пыли были обнаружены изменения под воздействием антропогенных факторов. Сделан вывод, что в зимний период в снеге накапливается широкий спектр тяжелых металлов, но основными металлами-загрязнителями являются Si, Fe, In, Al.

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Influence of work of the enterprise «Arselor Metall Steel» on the level of pollution of atmospheric air of Temirtau

In this article influence of the Arselor Metall Steel enterprise on the condition of atmospheric air of districts of the city of Temirtau, adjacent to the enterprise, is considered. The annual dynamics of the content of harmful substances in the air reflecting the main tendency of increase of the indicators values in summer months, mainly in July, decrease in September and repeated increase of values in November are shown. The main substances polluting the air were defined: dust, nitrogen oxides, sulfurous anhydride, phenol, ammonia, carbon monoxide, hydrogen sulfide. The analysis of the results showed that in the surface layer of the atmosphere of the studied areas the concentration of sulfurous anhydride and hydrogen sulfide considerably exceeds the standard values. According to the results of the research it was revealed that the region OKZhETPES, the area DNTI and 117 quarter belong to the zones, which are exposed to the most intensive negative impact, the quarter ABC belongs to the zone with the least pollution.

Key words: pollution of the atmosphere, iron and steel work, dust, nitrogen oxides, sulfurous anhydride, phenol, ammonia, carbon monoxide, hydrogen sulfide.

Air is the basis of our life. Clean air, is that basic, vital component, which must be taken into account in everyday life of a person. On its quality depends not only health of a person, but also condition of soil cover, water environment, flora and fauna in general. Fresh air is absolutely necessary for life of all living things on our planet [1].

Fixing and assessment of changes of condition of atmospheric air give a reliable picture and reflect the state of the environment.

Heavy metals are often called the most dangerous pollutants of the environment as they are highly toxic, can move with water and air streams, are capable to collect in soils, ground deposits of reservoirs. Excess of heavy metals in soil leads to their accumulation by plants and, consequently, to their excessive consumption by a person [2].

In recent years the economy of the Karaganda region is developing dynamically. But unfortunately, the industrial complex of the region, except important social and economic value, has also serious negative ecological consequences. The most ecologically unsuccessful cities are Temirtau and Balkhash, which share of the emissions of the area is more than 60 %. In Temirtau 90 % of emissions is the share of Steel department JSC «Arselormittal Temirtau,» which is the largest production object in the region [3].

In Temirtau, where the large steel mill is situated, high level of air pollution by several contaminants, including high hazard class, is noted.

The share of ferrous metallurgy accounts for about 50 % of the total harmful emissions into the atmosphere and soil.

Materials and methods of research

In the course of investigations, tests of atmospheric air of residential areas of Temirtau city during 2014 were selected.

When studying dynamics of pollution of atmospheric air of the city of Temirtau sampling was made on 4 posts: in the area OKZHETPES, the area DNTI, the quarter of ABC, the quarter 117 (Fig. 1), located in the zone of influence of the industrial platform of JSC «Arselormitall Temirtau», to define the main polluting substances: raise dust, nitrogen oxides, sulfurous anhydride, phenol, ammonia, carbon monoxide, hydrogen sulfide.

Route positions were chosen in accordance with RD 52.04.186–89 «Guidelines for the control of air pollution». Measurements were performed using a portable gas analyser GANK-4. In total 1460 samplings of atmospheric air were made. On each point not less than 3 instrument readings in an equal period of time were taken (indications were averaged). Tests of air were selected at the time of its greatest pollution from the downwind side of the pollution source. The duration of sampling was 15–20 minutes, at 0,5–2 meters from the ground.

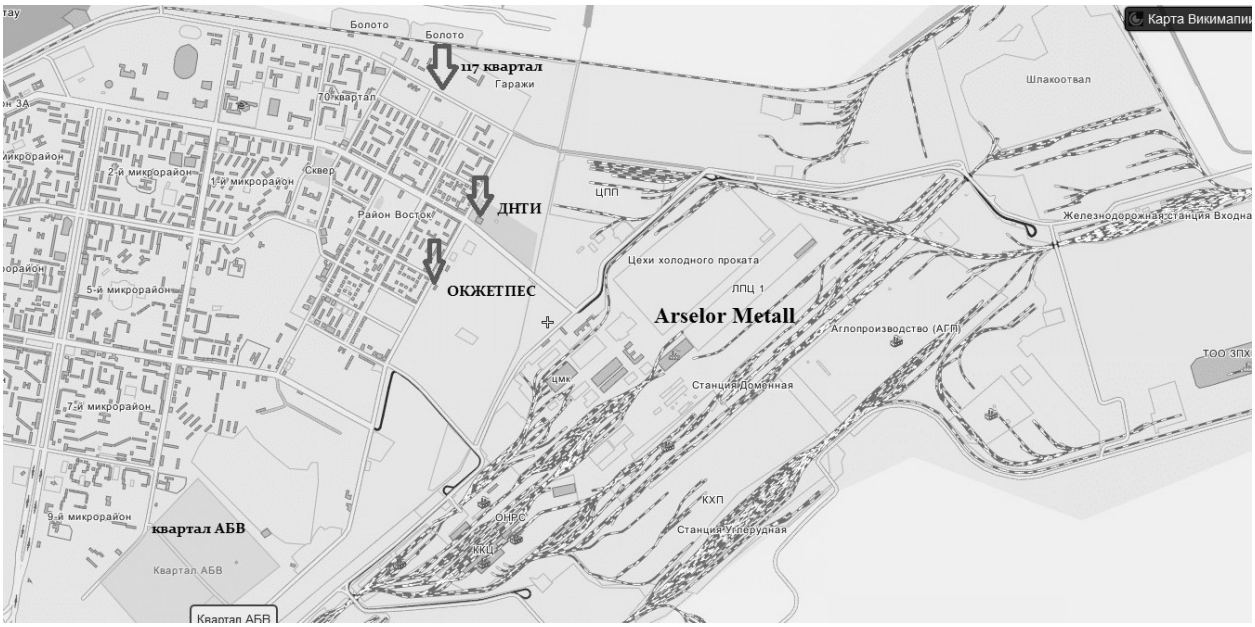

Figure 1. The areas of sampling of atmospheric air in Temirtau

JSC «ArcelorMittal Temirtau» is an enterprise with full metallurgical cycle, which also includes electric power stations: CHP (heat power station) -PVS and CHP-2. The main production objects are: production of agglomerate, coke-chemical production, blast furnace, converter and sheet-rolling shops.

In the process of agglomerate production to the atmosphere comes dust, carbon oxide, nitrogen oxides and sulfur dioxide [4, 5].

Technological process of steel-smelting production is followed by release of dust, carbon monoxide, oxides of nitrogen and sulfurous anhydride.

In blast furnaces production hydrogen sulfide and nitrogen oxides are emitted in addition, in rolling production aerosols of etching solutions, couples of emulsions and nitrogen oxides are also emitted. The greatest number of emissions is in coke-chemical production. Here except the listed pollutants it is possible to note the pyridine bases, aromatic hydrocarbons, phenols, ammonia, 3–4-benzopyrene, hydrogen cyanide, and others [6].

Figure 2 shows the data of the dynamics of atmospheric air condition in 2014 on the level of sulfur dioxide pollution in the area of OKZHETPES, district DNTI, ABC quarter, quarter 117**.**

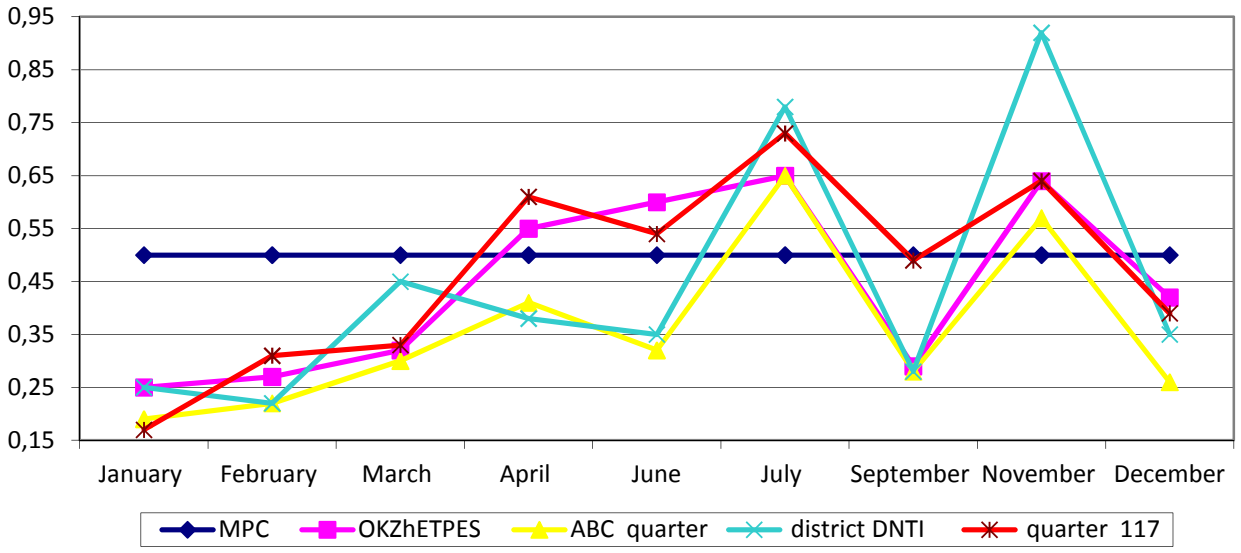

Figure 2. Annual dynamics of an indicator of sulfurous anhydride

Annual dynamics shows the growth of the indicator values from winter months to the summer period in all investigated parts of the city. In September decrease of an indicator to the level of maximum permissible concentration (MPC) is marked, that can testify to influence of atmospheric waters on air clarification, due to increase in precipitation [7]. Significant increase in amount of sulfurous anhydride in November in all studied areas can testify to increase in work of heat power stations in connection with a heating season. The main emissions in the atmosphere from combined heat and power plant are dust (ashes), sulfurous anhydride, nitrogen oxides.

The excess of maximum permissible concentration is noted during the period from April to July in the area of OKZhETPES and in the 117 quarter, the maximum values are noted in July and in November in all studied areas, and the maximum concentration is noted in the area of DNTI and makes 0,92 mg/m^3, while maximum permissible concentration makes 0,5 mg/m^3. The southwest direction of wind, at which there is an imposing of torches of emissions from CHPP-PVS and the power electric station located on the territory of the enterprise, can influence high concentrations in this area, it strengthens air pollution. Also from the received results it is possible to note that areas, subjected to the maximum pollution, taking into account values of an indicator of sulfurous anhydride, are DNTI and the quarter 117. Quarter ABC belongs to the area with the smallest level of sulfurous anhydride within a year, excess of maximum permissible concentration is noted in July and November and makes 0,65 mg/m^3 and 0,57 mg/m^3 accordingly.

Sulfurous anhydride is dangerous at inhalation. Even very small concentration of it creates unpleasant taste in a mouth and irritates mucous membranes. Vapors of sulfurous anhydride in damp air strongly irritate mucous membranes and skin. Adverse effect of sulfur dioxide may be aggravated by influence in combination with other substances, for example, carbon monoxide and oxides of nitrogen [8].

The level of air pollution with ammonia of areas adjacent to the territory of the plant can be seen in Figure 3.

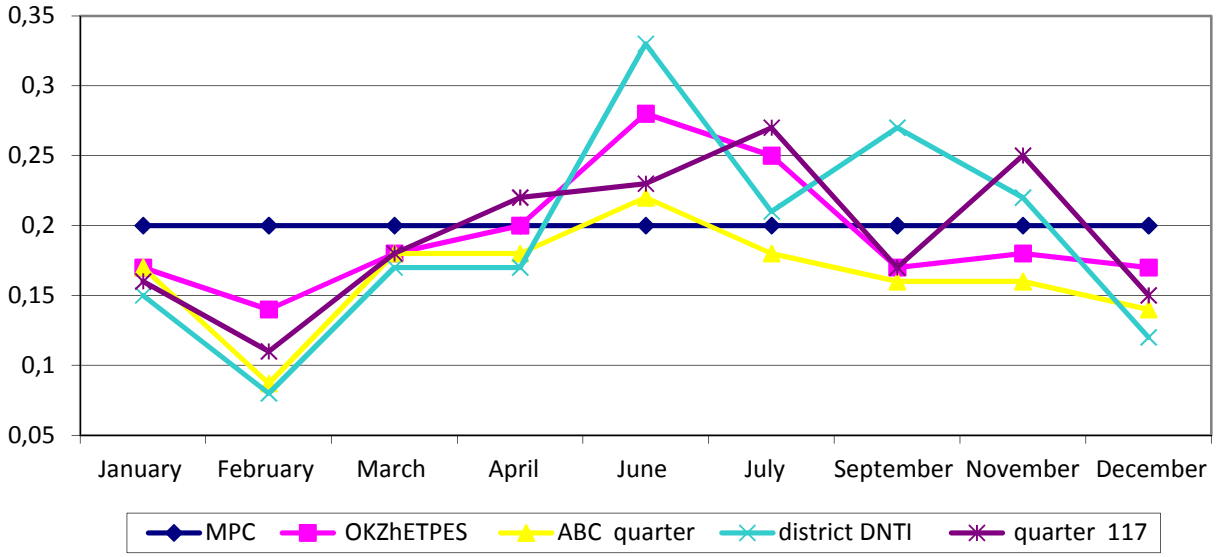

Figure 3. Annual dynamics of the level of ammonia indicator

Considering dynamics of values of the ammonia indicator in the air of the city of Temirtau within a year we observe a similar picture of change of level of pollution by sulfurous anhydride: the growth of the indicator from winter months to summer, decrease in September and increase of values in November, except for the region of DNTI where the value of ammonia in September exceeds MPC and makes 0,27 mg/m^3. The maximum excess of MPC is noted in June in regions of DNTI and OKZhETPES and makes 0,33 mg/m^3 and 0,28 mg/m^3 accordingly, despite the fact that the wind has the northwest direction. In the quarter 117 the maximum concentration is recorded in July and makes 0,27 mg/m^3, in November it corresponds to value of 0,25 mg/m^3 at the southwest direction of the wind, which promotes increase in concentration of substance. The smallest concentration of substance is observed in February in all studied areas. The quarter ABC can be considered the favorable area in relation to the level of air pollution by ammonia, in this area the excess of maximum permissible concentration is observed only in June and corresponds to value of 0,22 mg/m^3, with MPC equal to 0,2 mg/m^3.

In Figure 4 dynamics of the level of air pollution by hydrogen sulfide in the studied districts of Temirtau is presented.

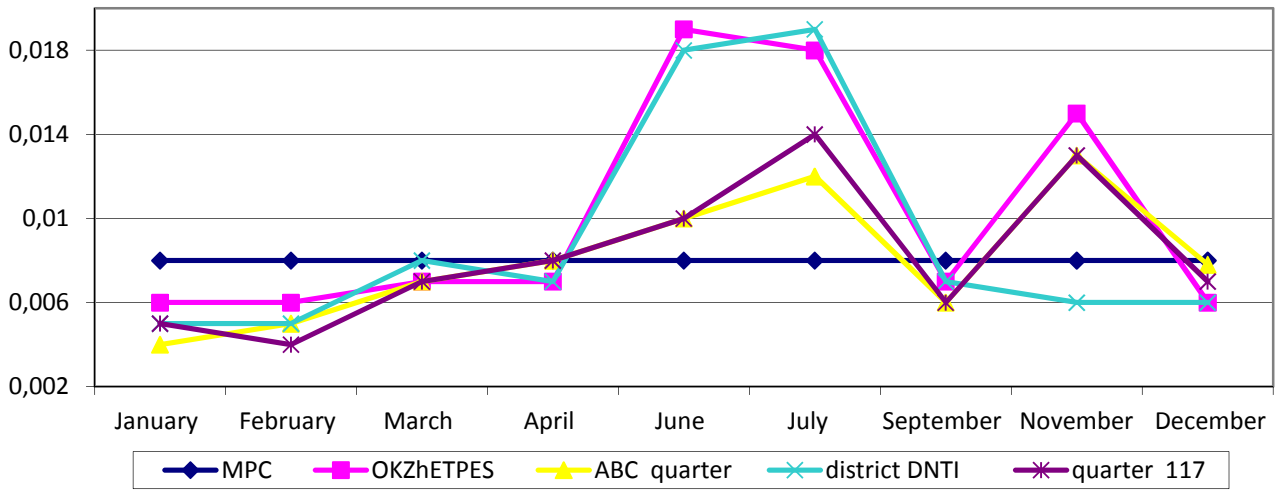

Figure 4. The annual dynamics of the level of the hydrogen sulfide indicator

In metallurgy hydrogen sulfide is emitted in the coke-chemical production, in the process of loading coal charge, delivery and suppression of coke. Also during the work of installations of granulation of slag and production of cast crushed stone steam-gas mix is formed, which part is carbon oxide, hydrogen sulfide, sulfur dioxide.

Annual dynamics of hydrogen sulfide indicator correspond to the above provided charts of indicators of sulfurous anhydride and ammonia, the increase of the indicator in June and July, the decrease in September and repeated increase in November is observed. In figure 4 it is possible to see that in all studied areas the amount of hydrogen sulfide exceeds maximum permissible concentration in June and July, though the wind has the northwest direction. In November the content of ammonia is high in three studied areas, only in the area DNTI there isn't any excess of maximum permissible concentration. In March and April indicators of the content of substance are on border of the MPC level, equal to 0,008 mg/m^3. The maximum values of an indicator can be noted in the area of Okzhetpes and DNTI — 0,019 mg/m^3.

The analysis of other four studied components showed that the increase of indicators happens in April and the maximum values are noted during the summer period, so in April the content of dust in OKZhETPES area is equal to 0,34 mg/m^3, in June it makes 0,35 mg/m^3, in the ABC quarter it corresponds to value of 0,29 mg/m^3 and 0,31 mg/m^3 accordingly, when MPC is equal to 0,3 mg/m^3. The nitrogen dioxide indicator in June in OKZhETPES area is equal to 0,091 mg/m^3, in November it is 0,089, when MPC is 0,085 mg/m^3. Phenol exceeds the value of MPC only in April in the quarter 117 and makes 0,012 mg/m^3, the direction of the wind is southwest, and that increases concentration of substance, as streams of the polluted air at such direction go from the enterprise territory towards the city. During all other period the indicator is in the limits which don't exceed the MPC. Carbon oxide within a year in all studied areas doesn't exceed the value of the maximum permissible concentration equal to 5 mg/m^3.

Thus, researches showed that the greatest air pollution is noted during the summer period and repeated increase in indicators takes place in November. It may be caused by various reasons (adverse weather conditions, growth of volume of an industrial output during summer period, etc.), which demand further more careful analysis, and carrying out additional research works. It is possible to come to the conclusion that the quarter ABC belongs to the zone with the smallest pollution.

In the level of emissions of harmful substances into the atmosphere and reservoirs, formation of solid wastes metallurgy surpasses all raw industries, leading to strong environmental pollution in areas, where the metallurgical enterprises work. Iron and steel works are the largest pollutants of atmospheric air in the areas of their location.

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Теміртау қаласында ауаның ластану деңгейіне «Arselor Metall Steel» кәсіпорынның әсері

Мақалада «Arselor Metall Steel» кәсіпорынның Теміртау қаласының осы мекемеге жақын аудандарының атмосфералық ауасының жағдайына әсері қарастырылған. Ауадағы зиянды заттардың жылдық динамикасы көрсетілген: шілде айында ол жоғары болған, ал қыркүйекте азайып, қарашада қайта жоғарылаған. Ауаны ластайтын негізгі заттар анықталды: шаң, азот тотығы, күкіртті ангидрид, фенол, аммиак, көміртек тотығы, күкіртті сутек. Нәтижелерді талдау барысында зерттеліп отырған аудандардың жердің беткі қабатындағы ауада күкіртті ангидрит пен күкіртті сутегінің концентрациясы қалыпты белгіден аса жоғары екені байқалды. Зерттеу нәтижесі бойынша жағымсыз әсерге көбірек шалдыққан ОҚЖЕТПЕС, ДНТИ аудандары және 117 орам, ал аз ластанған болып АБВ орамы табылды.

А.Е.Старикова, О.Ю.Ярошенко

Влияние работы предприятия «Arselor Metall Steel» на уровень загрязнения атмосферного воздуха г. Темиртау

В данной статье рассматривается влияние предприятия «Arselor Metall Steel» на состояние атмосферного воздуха прилегающих к предприятию районов города Темиртау. Показана годовая динамика содержания в воздухе вредных веществ, отражающая основную тенденцию увеличения значений показателей в летние месяцы, преимущественно в июле, снижение в сентябре и повторное увеличение значений в ноябре. Определялись основные загрязняющие воздух вещества: пыль, окислы азота, сернистый ангидрид, фенол, аммиак, окись углерода, сероводород. Анализ результатов показал, что в приземном слое атмосферы исследуемых районов концентрация сернистого ангидрида и сероводорода значительно превосходит нормативные значения. По результатам исследования было выявлено, что к зонам, подвергающимся наиболее интенсивному негативному воздействию, относится район ОКЖЕТПЕС, район ДНТИ и 117 квартал, квартал АБВ относится к зоне с наименьшим загрязнением.

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МЕДИЦИНА
MEDICINE

UDC 612

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The mechanism of action and manifestation of toxic effects of heavy metals on an organism (the literature review)

The literary review containing data on the main sources of intake of heavy metals in objects of environment and in an organism is presented in article. The characteristic of the term «heavy metals» is given to, the elements getting to group of heavy metals are defined the biological role and participation of heavy metals in biological processes is opened. Toxic properties of heavy metals, sources and ways of receipt them in an organism are lit. Besides, in article the general principles of impact of separate metals on an organism, and also their mechanisms are considered. The main attention is paid to toxic effect of lead, cadmium and copper on an organism.

Key words: heavy metals, mechanism of action, toxic effects, human organism.

The condition of health of the population directly depends on pollution of food source and food by contaminants of the chemical nature. One of the most dangerous pollutants of an ecosystem is heavy metals. Heavy metals include big group of the polluting substances which were widely adopted in environment. The term «heavy metals» has various treatments, and the quantity of the elements relating to this group changes over a wide range. Criteria of belonging to heavy metals are the atomic mass, density, toxicity, prevalence in an environment, degree of an involvement into natural and technogenic cycles. More than 40 elements of periodic system of D.I.Mendeleyev with atomic mass over 50 belong to heavy metals. Thus an important role is played their high toxicity for live organisms in rather low concentration and ability to bio-accumulation and a biomagnifikation.

According of Yu.V.Alekseev, heavy metals are a group of the chemical elements having density more, than 5 g/cm^3. In biological classification metals with the atomic mass more than 40 (manganese, iron, cobalt, copper, zinc, molybdenum, cadmium, mercury, lead, etc.) belong to heavy metals.

Otherwise definition of heavy metals and microcells at V.B.Ilyin (1991) who carries to heavy metals chemical elements with atomic mass over 50, with properties of metals and metalloids looks. Cobalt, nickel, copper, zinc, lead, cadmium, mercury are considered as the most toxic.

Biological classification of chemical elements relates heavy metals to micro and ultramicrocells groups [1]. It is known that at hit in environment in excess quantity, heavy metals are toxicant and ecotoxicant. The priority group relating to toxicant is distinguished from heavy metals. Among them is cadmium, copper, arsenic, nickel, mercury, lead, zinc and the chrome which are hazardous to human and animal health.

The greatest interest is represented by metals, accumulated in objects of environment and constituting serious danger from the point of view of their biological activity and toxic properties. Heavy metals separate on the following classes on toxicity degree for anhuman organzim: 1st class (most dangerous): Cd, Hg, Se, Pb, Zn; 2nd class: Co, Ni, Cu, Mo, Sb, Cr; 3rd class: Ba, V, W, Mn, Sr.

Environmental pollution by heavy metals has anthropogenous character and is caused by vigorous human activity. The main contribution to saturation of the atmosphere of the earth by xenobiotics is made by numerous industries, first of all: metallurgy, oil refineries, production of ceramics and glass [2]. Intake of heavy metals in an organism happens generally through respiratory organs, a digestive tract and by absorption through skin. In the most adverse way of penetration is hitting xenobiotics in an organism, in pneumatic ways in the form of dust aerosols that provides instant intake of heavy metals in blood. The progressing deterioration of an ecological situation leads to increase in concentration of heavy metals in drinking water and food that testifies to a significant role of an alimentary factor in receipt of xenobiotics in an organism [3]. Getting into the blood system, heavy metals accumulate in fabrics and bodies, and extent of accumulation of xenobiotics directly depends on the volume of blood supply and a sensity of fabrics to metals. Heavy metals influence practicallyall systems of an organism, rendering toxic, allergic, cancerogenic, gonadotropny action.

The range of ecological influences at the molecular, fabric, cellular and system levels in many respects depends on concentration and duration of an exposition of toxic substance, its combination with other factors, the previous state of human health and his immunological reactivity. Genetically caused sensitivity to influence of xenobiotics is of great importance. Mechanisms and speed of their penetration through different biological barriers and mediums depend on physical and chemical properties of the specified substances, a chemical composition and conditions of the internal environment of an organism.

In a number of works participation of metals in biochemical processes of activity of live organisms is studied and revealed that they can act as the limiting factor, or behave as toxicant. Harmful effects of ions of heavy metals on biologically active macrocells are connected with various processes: replacement of the metals by toxic metals; binding of part of a macromolecule necessary for normal organism activity; formation of the biological units harmful to an organism; depolymerization of biologically important macromolecules; the directed pairing of the bases of nucleotides and emergence of mistakes in proteinaceous synthesis [4].

The main pathogenetic mechanisms of cytotoxic effect of metals are considered: strengthening of peroxide oxidation of lipids, violation of a calcic homeostasis and oxidatemetabolism of a cell [5].

Pereoxidateoxidation of lipids is directly catalyzed by ions of metals with a transitional valency (arsenic, chrome, iron). Their accession can be connected also with reduction of anti-oxidizing protection of a cell. The last includes: cellular enzymes (a superoxiddismutaze, a glutationtransferasa, a catalase), some components of plasma (trans-ferrine, ceruloplasmin, albumine), capable to connect metals with transitional valency; small water-soluble antioxidant components (uric acid, bilirubin, vitamin C and fat-soluble vitamins — tocopherol and beta carotene) [6].

In animal experiments was shown that introduction of high doses of salts of cadmium and arsenic have led to activation of free radical oxidation that was connected on the one hand from hyperproductions of superoxidic anions and accumulation of metabolites of oxidizing reaction, with another — with exhaustion of natural antioxidants (ascorbic acid and tocopherol) in cells and/or with change of activity of anti-oxidizing enzymes [7]. The peroxidateoxidation of lipids induced by effect of salts of mercury and cadmium most intensively proceeded in mitochondrions, causing violation of their function [8].

One of targets of toxic effect of heavy metals ismitochondrions that was confirmed in experiences with the animals who were affected by salts of heavy metals. Change of a form, structure and the sizes of mitochondrions in the cell of kidneys and liver of experimental animals were revealed [5]. It is possible that on function of mitochondrions their ability to change the membrane cell potential is the cornerstone of the inhibiting effect of metals. So, influence of lead led to decrease by 75 % potential — dependent fraction of rhodamine in mitochondrions of an astroglia [9].

Cadmium is capable to inhibit enzymes of a cycle of lemon acid and an electronic transport chain: citrate-synthitase, a suczynate-dehydrogenase, cytochrome-C-oxidase [10]. Accumulation of proline in mitochondrions and decline in the ability of mitochondrions was shown to oxidize nicotinamide-adeninedinucleotide for 35 % under the influence of cadmium. Accumulation of proline is noted at effect of inhibitors of a respiratory chain of mitochondrions (cyanide of potassium, a rotenon) that is followed by decrease in concentration of the restored nicotinamide adenine dinucleotide with the subsequent violation of transformation of gliceraldehigrid-3-phosphate into 1,3-diphosphoglicerine acid. Compensative raises activity of processes with a nicotinamide adenine dinucleotide exit: transformation of a piruvat into ethanol or a lactate, an oxy acetate — in malat, a glicooxolate — in glycolate, a glutamate — in proline with development of metabolic acidosis. Thus, accumulation of proline in a cell reflects decrease in functional activity of

a respiratory chain of mitochondrions. A.Kesseler (2000) showed that cadmium stimulates leakage of protons, reducing thereby efficiency of oxidizing phosphorylation.

In vivo and in vitro was shown ability of cadmium to inhibit cytochrome-C-oxidase. Activity change ofcytochrome-R-450 plays a role in toxic effect of lead and cadmium [11].

Malfunction of mitochondrions at influence of mercury, cadmium, lead, arsenic, chrome finally is shown by decrease in production of macro-ergs, falling of activity of ATPh-dependent fermental systems and first of all K-Na-ATPhase to which share about 1/3 all cellular ATPh fall.

Refer to universal mechanisms of cytotoxicity also violation of a calcic homeostasis of a cell. Calcic receptors include a universal calmodulin, a protein-kinase C, specific to certain cell of a calcium medine, troponine C, etc. [12]. Researches showed that almost at a half of the patients living in the area polluted by salts of heavy metals took place decrease of Ca-ATphaseand Mg-ATPhase.

It was revealed that heavy metals can influence calcium — receptor system directly, by replacement of calcium on receptors or indirectly, through change of a stream of metal in a cell. In particular, it is established that lead, cadmium, mercury, arsenic block potential — sensitive calcic channels of cells. Along with it, lead, using calcic channels, gets through cellular membranes. The complex «lead-calmodulin» or «lead-proteinkinase C» increased activity of some intracellular enzymes [12]. It was shown that peak-molecularconcentration of lead activate a calmodulin for lack of calcium, and cadmium is capable to induce synthesis of a calmodulin [5]. The total calcium amount increased by 1 mg of a cellular protein at intoxication lead and cadmium, thus the most part of calcium was in mitochondrial fraction that could be caused by increase of cellular permeability and insolvency of the cells which were affected by xenobiotics to extract calcium [12]. Increase of concentration of intracellular calcium was followed by death of cells, perhaps, due to irreversible activation of phosphor-lypases, endo-nucleases, proteases and change of a cytoskeleton of a cell as a result of depolarization of an aktin and a tubulin [13].

Thus, modern researches proved that cytotoxicity of heavy metals can be caused by three mechanisms: 1) strengthening of pereoxidaseoxidation of lipids both due to decrease in anti-oxidizing protection of a cell, and due to direct pro-oxidatic activity of heavy metals, 2) oppression of mitochondrial breath owing to change of membrane potential of mitochondrions and violation of activity of enzymes of a respiratory chain and Krebs's cycle, 3) violation of a calcic homeostasis of a cell due to change of an intracellular stream of calcium, replacement of calcium on specific receptors with the subsequent activation calcium — dependent enzymes.

Bivalent metals contact to sulfgidrilny groups of the specific or not specific proteins which are carrying out transport function. To specific proteins belong methaltioneine, the connecting cadmium and zinc, lead — the connecting protein, transferrine, and ceruloplasmin. Metallotioneinis low-molecular protein with a molecular weight of 6500 daltons, characterized by the high content of cysteine. Structural researches of a molecule of a protein by method of nuclear magnetic spectroscopy revealed 2 metal clasters: the first is highly affine to zinc, the second is specific to cadmium. Metallotionein is synthesized mainly in a liver and kidneys. Its concentration is directly proportional to cadmic and zinc loading. Besides, the cadmium which came to an organism, first of all, accumulated in liver tissues. The ions of cadmium, which are freely circulating in blood, form strong complexes with low-molecular proteins –metallotioneins, which being filtered in the chanaldevice of kidneys, accumulate inside them and lead to damage of tubular department of nefron [14].

Zinc is one of the main pollutants of environment in connection with production and processing the zinc-content ores, during burning of mineral fuel, in metallurgical and chemical production. As a rule, together with zinc other pollutants get also to environment, such as cadmium and lead. Toxicity of zinc is caused by ability gradually to concentrate in food chains: plant-animal-person. By the rule of a trophic pyramid, the organic substance of each of the subsequent links of a food chain progressively decreases, and the amount of the absorbed metal remains and its concentration gradually increases, reaching the maximum at the human organism.

The biological role of zinc is defined by that it, being a component more than 300 enzymes, takes part in all types of an exchange, it is a part of the genetic device of a cell (there is about 100 zinc-content nucleoproteids). Without it, the correct replication of DNA and RNA is impossible. Zinc is a part of the greatest number of enzymes which take part in processes of blood formation and transport of oxygen, regulate a proteinaceous, carbohydrate and fatty exchange [15].

Differences between necessary amount of the zinc consumed with food and its toxic level is rather great. In spite of the fact that zinc is an important bio-element, its receipt in an organism in the increased quantities causes violations of a functional condition of separate bodies and systems. The hypoglycemia, a

hypoholesterinemia, increase of the maintenance of an urobilin and porphyrines in urine, violation of functions of a pancreas and liver, fibrosis of lungs are found in many workers occupied in production of oxide of zinc. Even when using respirators dust of oxide of zinc causes changes in the content of polysaccharides, peroxidases and sour phosphatases in blood cells; at an experience of 10 years anemia develops. In some cases not surplus, but a lack of zinc is toxic. It is caused by that zinc carries out a number of biological functions [16].

At hit zinc inside of organism glicoliticand oxidizing processes in muscles are broken. Oppression of a functional condition of barrier functions is observed as at surplus, and a lack of zinc of an organism. Activity NAD- and some PhAD-dependent enzymes sharply decrease at the low content of zinc that conducts to oxygen starvation of hydrobionts and other violations of a metabolism [17].

Participation of zinc in formation of immunity and functioning of intracellular membranes is known, that is essential acting for processes of regeneration of skin, growth of hair and nails, secretion of sebaceous glands. Besides, zinc takes part in an exchange of vitamins A and E, blood formation and activation of secretion of insulin. It is noticed that at increase in the content of zinc, cadmium, copper and manganese iron accumulation worsens. Excess of iron reduces ability of an organism to acquire copper and zinc. High concentration of zinc shows a sinergizm, strengthening effect of other pollutants [18].

Specifics of manifestations of symptoms at poisoning with cadmium are established, so at the sharp intoxication connected with inhalation receipt of a xenobiotic in an organism, pathological changes of pneumatic ways and respiratory organs develop in the shortest possible time. The further stage of poisoning is characterized by formation of bronchial pneumonia which leads to hypostasis of lungs and death of an organism [19].

Chronic poisoning with cadmium is characterized by considerable decrease in sensitivity of olfactory touch system, existence of frequent nasal bleedings and formation of emphysema of lungs. Possessing expressed gepato-and nephron-toxic action, in the conditions of chronic poisoning cadmium leads to destruction of a liver and injury of kidneys [20].

Cadmium comes to a human body orally, inhalation and through skin, and removed through intestines, with urine, a saliva, hair and breast milk [21]. At deficiency of calcium, iron and protein absorption of cadmium amplifies. About 50 % of the cadmium which came to an organism is found in kidneys, about 15 % — in a liver and about 20 % — in muscles. By different estimates the period of semi-removal of cadmium makes from 10 to 38 years. The critical organs characterizing intensity of cadmic load of an organism are kidneys [22].

Cadmium is the highly toxic element possessing polytropic action and is classified as one of the most dangerous cancerogenic substances for the human body [23]. Numerous clinical and pilot studies established direct dependence between intake of cadmium in an organism and development of oncological pathology of lungs, red marrow, liver, prostate gland, kidneys, a pancreas and stomach.

Cancerogenic effects of cadmium are connected with its ability to damage of structures of DNA by formation of the expressed oxidizing stress and thus to inhibition of processes of a reparation. Besides cancerogenic action, cadmium renders mutagen and teratogenic effects on an organism that is caused by partial destruction of the cellular device of a placenta and embryonic fabrics at early stages of an organogenesis [24].

Cadmium is polytoxic poison, in the pathogenetic mechanism of its action lies ability to reduce activity of enzymes, by inhibition carboxyl and the sulfgidrilnykh of groups. As result fermentative dis-function, violation of exchange processes and destruction of cellular membranes are evolved.

At chronic intake of cadmium in an organism was observedneurotoxic action that the ethyologocalfactors of development of neurodegenerate diseases, such as Parkinson's illness and Alzheimer's disease. By means of pilot studies was establishedthe expressed diabetogeneticeffect of cadmium shown in damage β-cell islands of a pancreas and suppression of secretion of insulin [25].

The pilot studies conducted by A.I.Vishnyakov and etc. (2011) established existence at cadmium of powerful toxic action on reproductive system that was connected with formation of changes of processes of an exchange of chemicals, in particular decrease in concentration of selenium in reproductive organs. Selenium is a natural antioxidant therefore it is obvious that formation of active forms of oxygen and an oxidizing stress is the cornerstone of the developing pathology.

In works of L.Wan is establishedthe cytostatic effect of cadmium caused by decrease in concentration of calcium in cells. Violation of a homeostasis of calcium is led in turn to damage by the actinovethreads of a cytoskeleton of cells and to braking of their growth.

Along with the functional violations which are formed at chronic poisoning with a xenobiotic, cadmium also leads to development of irreversible morphological changes in renal fabric. In work of M.N.Gonokhova (2007) was shown that the histologic picture of renal fabric in the conditions of cadmic intoxication was characterized by existence of an atrophy of a ball with a simultaneous hypertrophy of a capsule of Boumen-Shumlyansky, continuous hydro-dystrophy of mainly distalny department of tubules and sites of a necrobiosis the epitelium cells.

Cadmium possesses the expressed cardio-and angiotoxicaction. One of numerous mechanisms of vazoconstractiveeffect of cadmium is connected with its ability to change activity of calcic channels, to block effects of nitrogen oxide and other vasodilating substances. However in work of J.K.Angeli (2011) the vascular reactivity devoted to change in the conditions of cadmium influence, it is specified that damage the endotailed cells is products of pereoxidateoxidation of lipids whereas bioavailability of nitrogen oxide remains invariable the paramount reason of system vasoconstrictive action of a pollyutant.

It is established that men are more susceptible to destructive influence of cadmium on cardiovascular system. In the conditions of chronic poisoning, cadmium changes functional conditions of adrenal glands that are expressed in systematic increase in secretion of adrenaline which receipt in blood is starting mechanisms of development of arrhythmia [26]. In modern literature there are works which are proving existence of negative influence of cadmium on reducing ability of a myocardium.

Work of J.L.Peters and etc. (2010) confirms that toxic influence of cadmium increases chances of developing of a stroke of 35 % and chronic heart failure — by 48 %.

It is experimentally shown that the mechanism of toxic effect of cadmium on a liver is realized in two directions. At direct impact of cadmium on structures of a liver there are damages the endoteilcells of vessels of a liver connected with ability of a toxicants to interact with sulphhydrilgroups of molecules of proteinaceous structures in mitochondrions that leads to development of mitochondrial disfunction. Development of the ischemic phenomena arising owing to damage the endoteilcells of vessels of a liver leads to formation of a hepatic-cellular trauma. Formation of the inflammatory centers in the hepatobiliar structures causes development of the second mechanism of the toxic action connected with activation of activity of cells of Kupfer, powerful formation of cytotoxic and pro-inflammatory substances and also with the expressed infiltration of tissues of liver neutrophils [27].

In pilot studies it was shown that cadmium leads to formation of considerable changes in biochemical indicators of blood, and also causes activization of the hepatic enzymes (an alanine-aminotransferase, alkaline phosphatase and gamma glutamine transferase) which are markers of a hepatic trauma that testifies to a hepatotoxic activity of cadmium [28].

Gutnikova (2012) showed that the greatest sensitivity to toxic influence of cadmium mitochondrions and an endoplasmic network of hepatocytes possess. Toxic effect of cadmium promotes development of the total hydro dystrophy of hepatocytes passing with places into ballonny dystrophy.

A.A.Fouad (2013), etc. established that destructive effect of cadmium on a liver is led to massive formation of a factor of a necrosis tumor-α, cyclo-oxygenase-2 and substances from cysteine proteases family which in turn aggravate the pathological processes proceeding in liver tissue. Accumulationcadmium in hepatic fabric leads to activation of processes of apoptosis of hepatocytes that is connected with powerful stimulation of creation by a xenobiotic apoptosis — the inducing factor and considerable emission of cytochrome C in cellular cytosol. In the course of pilot studies it was established that cadmium in the conditions of poisoning leads to activation of an expression of the genes c-fos in hepatic tissue of experimental animals which are protooncogenes. Chronic influence of cadmium promotes the expressed decrease of the activity of ceruloplasmin in plasma of blood, the enzyme which is one of the main components of antioxidant protection of an organism.

The polytropy effect of toxic effect is caused by its ability to get into all systems of an organism as orally (with water and food), so through skin. Absorption of lead in a digestive tract at adults makes from 15 % arrived with food, and at children and pregnant women its absorption can reach 50 %. The lead-connecting protein has molecular weight about 27000 daltons is rich with glutamin, asparaginaminoacids, glycine, cysteine and connects about 40–50 mg of lead on 1mg a protein. Transport proteins cause a nephrotoxityof metals that the extra-cellular metal protein complex formed in a liver; it is a transport form of metal and promotes its filtration and absorption in kidneys [5].

The main places of application of toxic action of a toxicant are centraland peripheral system, cardiovascular system, system of blood and a kidney. The «lead polyneuritis» developing in the conditions of chronic poisoning belongs to clinical manifestations of defeat of nervous system, shown by paralysis of the top and

lower extremities. The formed cerebral violations in the conditions of lead poisoning are characterized by existence of speech disturbance, and in hard cases development of a toxic coma [29].

From the moment of penetration into an organism lead has toxic effect on system of blood. As a result of destructive effect of lead, there is a violation of elasticity of membranes of erythrocytes and development of a gemoliz. In the conditions of the created «lead anemia», the organism activates processes of an eritropoez owing to what predecessors of erythrocytes — retikulocytes come to the general blood-groove [30].

The expressed toxic activity of lead concerning a digestive tract is the reason of formation of functional changes of a stomach. In the conditions of chronic poisoning, the epithelium of a mucous membrane of a stomach actively sekretirut lead ions that leads to blocking of the enzymes necessary for start of regenerator processes of a mucous membrane, development of atrophic changes in a stomach is a consequence of that [31].

Destructive effect of lead on kidneys, as at sharp, so at chronic influence leads to formation of pathological changes in the glomerule-tubulyar device of kidneys. Decrease in level of chanalreabsorption in the conditions of intoxicationlead is a consequence of primary defeat of proximal tubules of a nefron [32].

Activating education and slowing down removal from an organism of aminolevuline acid, lead in the conditions of chronic poisoning promotes its accumulation in an organism that the histo-structural damages of glomerular and the chanal components of a kidney which are confirmed by increase of lead concentration in final urine β2-microglobuline [33].

One of mechanisms of nephrotoxicaleffect of lead is ability to activate processes of apoptosis. Works of Q.H.Jia, carried out in 2011, allowed to establish existence at lead of pronounced ability to lead to creation by a vacuole in cytoplasm of cells of kidney tubules with activation of processes of acaryo-picnosisthat confirmed existence of the initial stages of apoptosis of a tubular epithelium. In addition, lead is capable to start processes of apoptosis not only in the chanal device of kidneys, but also in the mesogial cells of the usta-glomeratedevice, by activation of processes of peroxidantoxidation of lipids and accumulation of products of a lipoperoxidationin cytoplasm of cells.

In experiments is shown that effect of lead on cardiovascular system is caused by change of excitability and a reduction of a cardiac muscle; decrease in formation of nitrogen oxide; the raised tone of the centers of sympathetic nervous system. Besides, activation renin-angiotensin-aldosteron system, strengthening of synthesis of an endotelin, formation of atherosclerotic damages of vessels walls is revealed.

In the researches L.Molero and etc. (2006), was established that at intoxication increase of activity of the endotelin in the vascular course causing growth of arterial pressure happens lead. Blocking processes of synthesis and secretion of the fabric activator of a plazminogen in the epitelial cells of the vascular course, lead causes probability of development of processes of an intra vascular trombo-creation.

The researches conducted by O.S.Choubina and etc. (2011) allowed to establish existence of structural changes in a cardiac muscle at chronic lead intoxication. Total change of the sizes and forms of the cellular kernels enriched chromatin was noted.

Lead has direct hepatotoxic action which realized by direct influence of a xenobiotic on processes of peroxide oxidation of lipids in hepatic fabric. In the conditions of chronic lead poisoning there is an activation of processes of a lipoperoksidation to at the same time happening decrease of the activity of enzymes of antioxidant protection which leads to strengthening of processes of fragmentation of DNA. Formation the histological changes of a liver in the conditions of lead poisoning confirms hepatotoxic action of a toxicant. The lead-mediated hepatic hyper-cholesterolemia is connected with activation of the enzymes participating in cholesterol synthesis (3-hydroxy-3-methylglutaril-KoA reductase, farnezil-diphosphate synthetase, a squavel-synthetase), with synchronous decrease of the activity catabolic of the enzymes (7a-hydroxylase) influencing cholesterol [34]. Degree of expressiveness of functional and morphological changes in a liver at chronic influence of lead depends on age of an organism.

In works of Yu.V.Kireeva (2006) and N.I.Kucherko (2007) morphological features of toxic influence of lead are also established. Total hypostasis of hepatocytes which cytoplasm was vacuolization was noted. Changes in structure of blood vessels were characterized by a thickening of walls with perivascular hypostasis.

Copper is irreplaceable element necessary for normal activity of an organism. Adverse effects can be observed both at surplus, and at a lack of copper. Excess of copper leads to its accumulation in a liver with the subsequent destruction of erythrocytes and increase of concentration of bilirubin. At excess of copper is oppressedthe lipase, pepsin, urease and amylase. Copper takes part in phenolic, nitrogenous and nucleinic exchanges; is a structural specific component of a number of oxidases; plays large role in processes of blood

formation participation in synthesis of hemoglobin and other iron-porphirine (cytochromoxydase, cytochrome and catalase). In physiological doses copper increases immunobiological activity and resilience of organism to adverse effects. Besides, copper stimulates activity of hormones of a hypophysis.

It is studied that excess of copper causes functional frustration of nervous system, and at steam inhalation can be shown as «copper fever». Violation of functions of a liver and kidneys with development of cirrhosis and secondary damage of a brain is known as Wilson-Konovalov's illness and is connected with genetic disorders of an exchange of copper and proteins [35].

Mechanisms of toxicity of copper are connected with increase of cellular permeability of erythrocytes owing to interaction with their sulphichydrilgroups, glutationreductaseinhibition, decrease in the restored glyutation, agglutination of erythrocytes, and excess stimulation of the hexozomonophosphateshunt. Copper possesses selen-antogenousproperties (causes deficiency of selenium in high doses). Copper takes part in providing an immune homeostasis, high doses supressirut the T-dependent immune answer, reduce synthesis of IL-1V and IL-2V and hemo-taxis of leukocytes [35]. For animals copper, in assigned amounts, is necessary as a blood formation stimulator. It promotes binding of toxins, intensifies processes of free oxidation in fabrics, influences reproduction processes, normalizes an exchange of calcium and phosphorus. Copper is necessary for a normal keratinization of a feather and normalization of an embryonal development.

Thus, influence of heavy metals on live organisms very variously, is noted them a dual biological role: metals as elements necessary for life, and metals as toxicant. It is caused by biochemical functions which they carry out in an organism; physical and chemical properties, specific features of behavior of metals in environment, forms of existence of metals in ecosystems.

Due to the intensive growth and development of the industry, transport, and chemical using in agriculture in recent years receipt in environment of heavy metals of a technogenic origin considerably increased. Uncontrollableenvironmentalpollutionby heavy metals threatens human health. It indicates the need carrying out environmental monitoring of the content of heavy metals in air, water, the soil, plants and animals; condacting of sanitary and hygienic monitoring of food raw materials and food on availability in them of heavy metals; further studying of chains of migration of heavy metals from their source to the person.

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А.Е.Конкабаева, Т.Н.Баранова, М.Ю.Ишмуратова

Ауыр металдардың ағзаға уытты әсерінің пайда болуы және әсер ету тетігі (әдебиетке шолу)

Мақалада ауыр металдардың қоршаған ортаға және ағзаға негізгі түсу көздері туралы ақпаратты қамтитын негізгі әдебиетке шолу жасалған. «Ауыр металдар» терминіне анықтама берілді, ауыр металдардың тобына кіретін элементтер анықталды, биологиялық процестегі ауыр металдардың қатысуы және биологиялық рөлі ашылды. Ауыр металдардың уытты қасиеттері, ағзаға түсу жолдары мен көздері қамтылды. Сонымен қатар жекелеген металдардың ағзаға әсерінің жалпы қағидалары, сондай-ақ олардың механизмдері сипатталды. Қорғасын, кадмий және мыстың токсикологиялық әсеріне басты назар аударылды.

А.Е.Конкабаева, Т.Н.Баранова, М.Ю.Ишмуратова

Механизм действия и проявления токсических эффектов тяжелых металлов на организм (обзор литературы)

В статье представлен литературный обзор, содержащий сведения об основных источниках поступления тяжелых металлов в объекты окружающей среды и в организм. Дана характеристика термину «тяжелые металлы», определены элементы, попадающие в группу тяжелых металлов, раскрыты биологическая роль и участие тяжелых металлов в биологических процессах. Освещены токсические свойства тяжелых металлов, источники и пути поступления их в организм. Кроме того, в статье рассматриваются общие принципы воздействия отдельных металлов на организм, а также их механизмы. Основное внимание уделяется токсическому действию свинца, кадмия и меди на организм.

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Assessment of the regulatory systems of the body of children in the early childhood

The assessment of the regulatory systems of the body of children in the early childhood was conducted by using physiological and clinical examination in junior classes of secondary school. Morphological and functional development of children was evaluated in terms of height, body weight, cardiovascular system was assessed by changes in heart rate, SBP, DBP, PP, ECG, systolic blood volume (SV) and blood oxygenation. State of regulatory systems was measured by heart rate variability (HRV), analyzing the common basic parameters of cardiointervalography: M, IC, Mo, Amo, VR and their derivative indicators by R.M.Baevsky: VIR (vegetative index rate), VBI (vegetative balance index), SI (index of regulatory systems stress) ARP (adequacy of regulation processes).

Key words: adaptation, heart rate variability, vegetative parameters rhythm performance, heart rate, parasympathetic mechanisms sympathetic influence.

Adaptation of pupils to the school — a complex dynamic social psychological and physiological process accompanied by a significant stress of the organism and its functional systems against a background of continuous growth processes [1–4].

The study of children's organism adaptation to various environmental influences — is one of the most important directions of physiology. Cardiovascular system determines the success of the adaptive response of the organism to a variety of external influences [5].

The scope of the study of adaptive processes is increasingly includes such areas as «psychological adaptation», «social adaptation», «social and economical adaptation» and even «ideological adaptation». School education traditionally focused on the contingent of healthy children for decades, in recent years has intensified: the programs are getting more complex, new educational technologies and elements of specialization introducing from the first-class. The increase in the total load is carried out without taking into account the recommendations of modern hygiene, exposing up to 80 % of younger schoolchildren undue stress (V.R.Kuchma).

One of the leading problem in the study of the physiologists is adaptation of children and adolescents to educational and physical activities. The main goal of this research is to study the physiological mechanisms of adaptation of the body of children and to be able to influence it by means of pedagogy and hygiene.

The educational system in Kazakhstan over the past decade is in the process of reform. Primary education — is not only one stage of the continuous education system, and also the first stage of school education. It was first touched with all sorts of innovations and changes at almost all levels, at the school, regional and state levels.

Factors adversely affecting the health of schoolchildren are inappropriate methods and technologies of training according to age and functional abilities of the child, irrational organization of educational process, violations of sanitary and hygienic learning environment. The significance of these factors is determined by the duration, regularity and continuity of their impact on the body of child. The widespread adoption of educational technologies is carried out, usually without any preliminary physiological and hygienic studies.

An important role in violation of physiological and hygienic norms plays parents who load their children more information in a variety of developing centers. Almost every parent believes that in addition to nursery school the child should attend developing training classes. The child has no leisure time.

Meanwhile, the processes of adaptation mechanisms of regulation of children under the implementation of innovative learning technologies are not well understood.

The aim of our study is to assess the regulatory systems of the body of children in the early childhood in the conditions of innovative educational technologies of the educational process.

To implement the goals and objectives were carried out physiological and clinical examination in junior classes of secondary school. 50 school children in the age of 8–9 years were examined, including 21 girls and 29 boys. Adaptive response to school stressors of pupils of two groups was studied: group 1 — children

entering first grade after attending kindergarten, group 2 — the children who attended kindergarten in addition with developing centers. Morphological and functional development of children was evaluated in terms of height, body weight, cardiovascular system was assessed by changes in heart rate, SBP, DBP, PP, ECG, systolic blood volume (SV) and blood oxygenation. State of regulatory systems was measured by heart rate variability (HRV), analyzing the common basic parameters of cardiointervalography: M, IC, Mo, Amo, VR and their derivative indicators by R.M.Baevsky: VIR (vegetative index rate), VBI (vegetative balance index), SI (index of regulatory systems stress) ARP (adequacy of regulation processes).

Analyzing the average parameters of morphological and functional development of children, the body weight of boys in this age is lower than body weight of girls (Table 1). The greatest difference in body weight was found between subgroups of girls and boys who attended additionally development centers (31.77 kg — girls in comparison with boys — 29.92 kg). The children who attended kindergarten have small difference (31.29 kg and 30.55 kg, respectively) (Table 1). The height of boys and girls at this age is almost the same (Table 1), but the height of boys attending only kindergarten, taller than girls in the same group on 1.35 cm and the boys from group2 taller than girls of group 1 on 2 cm. Height of boys and the girls of second group is almost the same.

Table 1

Comparative characteristics of anthropometric parameters, blood pressure and oximeter

		Weight, kg	Height, cm	SBP, mmHg	DBP, mmHg	SpO_2, %
G	I	31,29±4,9	128,29±2,8	84,29±7,8	45,71±4,3	95,71±0,8
	II	31,77±1,5	129,69±1,4	89,62±4,2	53,85±2,5	97,08±0,4
B	I	30,55±1,7	129,64±1,3	93,18±4,3	54,55±3,8	96,82±0,6
	II	29,92±1,4	130,15±1,6	89,23±3,3	50,77±3,3	95,31±1,2

Systolic and diastolic blood pressure which is mainly affected by the emotional reaction in this age of boys is higher. The largest difference is noted in the values of blood pressure in boys and girls of1st group (up to 9 mmHg). Systolic pressure between boys and girls of 2nd group is equally, the diastolic pressure of girls is higher (Table 1). Pulse pressure of boys is equally in both groups, the result of girls from 2nd group is lower on 3 mmHg, wherein oxygen saturation of the blood in girls of this group is higher at 97.08 %, while in boys it is 95.31 %. At children who attended only kindergarten oxygen saturation is higher at boys (Table 1).

Analysis of statistical parameters of HRV showed no significant changes in the mean of RR intervals duration and standard deviation characterizing the vagal regulation in boys and girls (Table 2). The difference is clearly seen between girls and boys of 1st and 2nd groups. Despite the fact that the value of M (RRNN), has the lowest volatility among all indicators of heart rhythm, it is lower at girls attending the centers of developing training than at boys of the same group. It is also noted that the value of IC (SDNN) in girls in comparison with boys of the group is lower (Table 2). Among children who attended only kindergarten these indicators higher in girls than in boys of the same group, which indicates to a greater stress resistance of girls.

Variation pulsometry index is higher at boys when compared the groups who attended kindergarten only. As for the second group, the AMO% and VR indexes of girls are higher than indexes of boys, it indicates to an increase in sympathetic activity and regulation systems tension of girls in this group.

As shown in studies of L.A.Dotsoev and N.I.Shlyk in the age between 4–10 years influence of the parasympathetic division of the ANS increases and decreases the activity of the central contour of regulation [6, 7]. The optimal ratio between the nervous and humoral mechanisms of regulation of cardiac activity is formed with age [7–9]. Several authors show sex differences in heart rate regulation, starting from the age of 8 [9–12]. According to some authors [9, 13] 9 years age is characterized by the increasing influence of the parasympathetic division of the ANS and reduce the activity of the central contour of regulation.

The study E.A.Kalyuzhny (2010) in the analysis of vegetative homeostasis of junior classes children by cardiointervalography revealed the predominance of the sympathetic component, statistically different from the benchmarks of cardiointervalography. Examined children at the time of the beginning of the school year had the average value of stress index (SI) that corresponded to the border sympathicotonia andhypersympathicotonia, mainly due to an increase in mode index (Mo), amplitude mode (AMo in%). SI amount varies in dynamics of the academic year, indicating stress response of children to workload. In general determined next trend: the value of SI is rised at the end of a quarter, and reduced after the holidays and the end of the school year [14].

Table 2

Heart rate variability in primary school children

		M, s	IC c∧2, ms	Mo, s	AMo,%	VR, ms	VBI, c.u.	ARP, c.u.	VIR, c.u.	ID, c.u.
G	I	0,73 ±0,03	0,07 ±0,01	0,73 ±0,08	32,80 ±1,2	0,31 ±0,02	111,14 ±12,8	47,19 ±6,5	4,88 ±0,7	82,11 ±13,5
	II	0,64 ±0,02	0,05 ±0,008	0,64 ±0,02	43,68 ±2,4	0,35 ±0,1	204,10 ±34,8	68,55 ±4,6	7,01 ±1,05	173,94 ±19,7
B	I	0,67 ±0,03	0,06 ±0,009	0,66 ±0,02	40,30 ±4,1	0,32 ±0,06	199,42 ±30,9	64,28 ±7,6	6,97 ±1,4	167,44 ±43,3
	II	0,69 ±0,02	0,08 ±0,08	0,68 ±0,03	42,14 ±2,7	0,40 ±0,1	182,16 ±30,9	64,21 ±4,9	6,19 ±1,5	145,05 ±14,5

The increase in the degree of centralization of heart rhythm of girls that attend additional developing centers indicate higher derivative indexes in this group in comparison with boys (Table 2). In group that attended only kindergarten stress of regulatory systems noted in boys.

The evidence of parasympathetic mechanisms activation is a reduction in the activity of autonomic response, adequacy of regulation processes and vegetative index rate [15].

The study of the state of the central contour of heart rate regulation has shown the prevalence of parasympathetic regulation of heart activity in boys, that increases adaptive capacity and effective use of reserve capacity of the cardiovascular system.

According to our findings revealed that boys have dominated parasympathetic regulation, which is reflected in the decrease of the VBI. SI is higher in girls than boys, which is likely due to the fact that the adaptation of the physiological systems of boys in comparison with girls in the training load is given by the stress of the central part of heart rate regulation.

HRV analysis showed that at the age of 8–9 years, the sympathetic influence is stronger in girls, so dominated in comparison with boys that attended only kindergarten, so it is possible to identify the sex differences.

The brightest adaptive response is in subgroups of children that have attended kindergarten. Considering SI as one of the main indicators reflecting the degree of centralization of heart rhythm, the table shows that among the children who attended developing centers, more sympathotonics in comparison with children who attended only kindergarten.

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Төменгі сынып мектеп балалары ағзасының реттеуші жүйелері жағдайын бағалау

Төменгі сынып мектеп балалары ағзасының реттеуші жүйелері жағдайын бағалау, жалпы білім беру мектебінің төменгі сынып оқушыларын физиологиялық-клиникалық зерттеу арқылы жүзеге асырылды. Балалардың морфофункционалды дамуы бойы, дене салмағы арқылы, жүрек-қан тамыр жүйесінің жағдайын ЖЖЖ, САҚ, ДАҚ, ПҚ, ЭКГ және қанның систолалық көлемі (СК) қан оксигенация динамикасы бойынша бағаланды. Реттеуші жүйелердің жағдайын жүрек ырғағының түрленгіштігі (ЖЫТ) әдісімен, көпшілікпен мақұлданған кардиоинтервалографияның негізгі параметрлерін: М, СК, Мо, АМо, ВА және Р.М.Баевскийдің туынды көрсеткіштері: ЫВК (ырғақтың вегетативті көрсеткіші), ВТИ (вегетативті тепе-теңдік индексі), РПБК (реттеуші процестердің баламалылық көрсеткіші) бойынша оларды талдай отырып, анықталды.

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Оценка состояния регуляторных систем организма у детей младшего возраста

Оценка адаптивных системных реакций организма учащихся младших классов проведена с помощью физиолого-клинических обследований учащихся младших классов общеобразовательной школы. Морфофункциональное развитие детей оценивали по показателям роста, массы тела, состояние сердечно-сосудистой системы — по динамике ЧСС, САД, ДАД, ПД, ЭКГ, систолическому объему крови (СО) и оксигенации крови. Состояние регуляторных систем определяли методом вариабельности сердечного ритма (ВСР), анализируя общепринятые основные параметры кардиоинтервалографии: М, СК, Мо, АМо, ВР и их производные показатели — по Р.М.Баевскому: ВПР (вегетативный показатель ритма), ИВР (индекс вегетативного равновесия), ИН (индекс напряжения регуляторных систем), ПАПР (показатель адекватности процессов регуляции).

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Influence of heavy metals on an environment and health of population

The literary analysis of influence of heavy metals is Given on an environment and organism of man. Heavy metals are the basic pollutants of environment of industrial cities. Connections of heavy metals possess high biochemical activity, ability to accumulate in an environment and living organisms. The important role of microelements is educed as catalysts of many biological reactions and pathogenic influence of heavy metals on the organism of man. The basic sources of receipt of heavy metals in an environment are extrass of industrial enterprises and exhausts of motor transport. The high concentrations of heavy metals in an environment can result in the decline of adaptive reactions of organism and development of the sickly states.

Key words: contamination, influence, factors, environment, heavy metals are lead, zinc, cadmium, concentration, level, toxic influence.

The modern economy is characterized by intensive take-off of industry, growing number of road transport, energy and agriculture. It causes significant pollution of the environment, which in its turn affects the state of health of the population.

The complex of environmental factors has an impact on the formation of health among population which is connected with change of social and economic conditions, accompanied by a weakening of control over the quality of habitat, deterioration of demographic situation, changes in the structure of nutrition among population. Analysis of quantitative dependencies in the «Environment – Health» system was worked out within the development of criteria and methods of quantitative assessment of the impact of environmental factors on human health [1–4].

In recent years, prior environmental pollutants of environment in industrial cities are heavy metals; they significantly leave behind such pollutants as oxides of carbon, nitrogen, sulfur and oil products.

Heavy metals is a group of chemical elements with the properties of metals, with significant atomic weight or density, high toxicity, wide propagation in the natural environment, as well as involvement into technogenic cycles. These include more than 40 metals with atomic weight higher than 50 atomic units: V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Mo, Cd, Sn, Hg, Pb, Bi and others. Important characteristics of heavy metals are high biochemical activity and ability to accumulate in the tissues and organs of living organisms having a negative effect on the body.

The main sources of heavy metals in the environment of human are industrial gas emissions and exhaust emissions of road transport. High concentrations of heavy metals and the change of microelement composition of the environment can lead to the so-called technogenic biogeochemical provinces and, consequently, to a violation of protective and adaptive reactions of the organism, the emergence of new pathologic states, the so-called microelementosis.

It is known that imbalance of macro- and microelements in the environment gives the way to the development of diseases which are characteristic for both natural and artificial biogeochemical provinces, as evidenced in the researches of V.I.Vernadskiy, A.P.Vinogradov, V.I.Voynar, G.A.Babenko, A.P.Avtsyn, A.A.Zhavoronkov, A.V.Skalniy, W.Mertz, P.J.Aggett. In the literature, there are numerous data on the relationship of amount of metals in environment and industry and their content in the blood serum. Thus, there is a positive correlation between the content of cadmium in the air, food and its content in the blood [4], the lead content in the air of cities and its content in the blood. During the mining, smelting and processing of non-ferrous alloys, workplace air contains high concentrations of lead and copper, which leads to their higher content in the blood serum [5, 6]. The research of V.L.Suslikov [7] obtained relationship between deficiency of iodine, fluorine, cobalt, zinc and molybdenum in the diet and their content in the blood of population. At the same time, the determination of microelements in human blood suffers from certain disadvantages. Daily and weekly fluctuations in the concentration of microelements may vary considerably, making it difficult to determine their average content. Besides, the concentration of certain microelements is extremely small, and their levels in the blood can be associated both with specific and non-specific biotransformation in the pathogenic processes such as stress, increased physical activity and etc. (metally-dependent enzymes). However,

from our point of view, the content of metals in the blood is that stable biological environment which informatively characterizes changes in the balance of microelements in the body.

In the economic space of the CIS Kazakhstan plays a leading role in the production of chromite ore. The leading ones are polymetallic dusts of complex chemical composition and aerosols containing all the main components of ore [8]. Peculiarity of airborne dust of polymetallic mines is that they contain highly toxic metals (Zn, Cr Cu, Pb, Co and etc.). They have significant general toxic, hepatotrophic and carcinogenic effect [9].

Currently, we identified the main or structural elements, whose presence in the living matter is primarily connected with their high content in the biosphere. They are vital for the human body, but their effects should be assessed taking into account the biogeochemical situation in the external environment. Increase of anthropogenic contamination, including microelements, is so serious that it cannot be ignored [10]. Microelements have a significant impact on the homeostasis. It is known that, for zinc, manganese and copper there is no importance how they get into the body (inhalative, alimentary, parenteral). These microelements freely penetrate into the blood and are also selectively eliminated with urine. For other elements (lead, cadmium and etc.) the processes of absorption into the gastrointestinal tract depend on the availability of special media — metallothioneins [11–13]. Hair reflects cell metabolism, as well as any tissue (visceral and ectodermal) as microelements get involved in the proximal end of the growing hair as it exits from the follicle. The principal endogenous sources of microelements in the hair are matrix and the connective tissue of papilla with its blood vessels. The sebaceous glands of the skin make less contribution. They deliver microelements from the body tissues and epidermis. There is no doubt that if the hair is used as biopsic material to assess the effect of microelements of the environment, than the groups, carefully selected for their place of residence, must be compared. As a result, we have proposed this experiment.

Balkhash region is one of the leading industrial regions of Kazakhstan. Environmental situation in Balkhash region is mainly determined by the Balkhash Mining and Metallurgical Plant (BMMP), which is a major source of air pollution, as it accounts for about 85 % of all industrial enterprises emissions of the city [14]. Industrial emissions of this plant contain a large amount of solid dust particles, which contain metals. As the city has no clear boundary between industrial area and the city the soaring urban dust has all the metals presented in industrial dust, such as lead, mercury, cadmium, copper, chromium, zinc and etc. When they accumulate in the body they have a toxic effect.

The studies of M.A.Mukasheva [15, 16] evaluated the degree of accumulation of metals in the organism of experimental animals. The dust consisted of the following metals: lead, zinc, nickel, chromium, copper, beryllium, tin, cobalt, manganese, wolfram, titanium, selenium. The concentration of metals in dust ranged from $3 \cdot 10^{-3}$–$5 \cdot 10^{-4}$ %. Dispersity of dust up to 5 microns was 80 %, up to 8 microns — 20 %. Organic part of the dust was a complex composition of the polynuclear alkyl-substituted and humic acids which form chelate compounds with metals. Fluoros showed that the highest concentration of heavy metals were found in the organs, which have a high sorptive activity — kidneys, liver. Thus, the largest content of metals was found almost about all studied elements in the liver. Respectively the control the increase was observed for Ni — 50 times, V — 30 times, Mn — 24 times, Cu — 20 times, Pb — 12,5 times, Zn — 4,4 times and Cr — 1,7 times. In the kidney, the excess over the control was observed for Mn — 315 times; V — 83 times, Cr — 71 times, Cu — 60 times, Pb — 12,7 times, Ni — 12 times, Fe — 8,5 times and Zn — 8,5 times. Copper is accumulated in the lungs, heart and brain more intense than in the liver and kidneys — in 214; 36 and 29 times respectively. Accumulation of Mn, Ni, Pb and Cr in the lungs was observed at 33, 26, 20 and 3 times respectively. Increased accumulation occurs on the same elements and in the heart Pb — 11 times, Mn — 6, 7 — times, Cr — 5 times. The most intensive accumulation of metal in the heart in comparison with other elements had Zn — 36 times. Ni in the heart could not be detected. However, this element had the highest content in the brain, 33 times relatively to control. Such studied elements as Pb, Cu, Mn, Zn, Cr had excess relatively to control at 32; 29; 11; 6; 2, 8 times respectively. Content of Be in animal's organs is considerably less than lead, but because of the strong toxicity of this metal danger is even a small concentration. Accumulation of this element reaches the highest values in the kidneys (2.0 mg / kg).

The nature and level of accumulation of metals in various biological media of human reflects the degree of pollution in the natural anomalous geochemical provinces, and allows us to study technogenic burden [17].

The situation in Kazakhstan causes a complex multi-factorial impact of the environment on human health. It creates necessity to take actions aimed at the adoption of specific solutions to control the status of heavy metals in the environment in the «habitat — man» system [18, 19].

When heavy metals get into the body they accumulate in various tissues and then have toxic effects on the body. These substances in small doses have nonspecific effect which is realized through the accumulation of asymptomatic changes in tissues and organs, and manifest quickening and complications of somatic pathology. Informative diagnostic indicator for this is the study of heavy metals in biological media.

By us revealed that shaft miners had excess in: lead 2.4 times, copper 2 times, zinc 1.9 times, manganese 4.2 times; stope miners — lead 2.6 times, copper 2.1 times, zinc 1.5 times and manganese 4.2 times; scrapermen and crushers — lead 2.3 times, copper 1.8 and 1.4 times, zinc 1.3 and 1.5 times and manganese 1.7 times in comparison to the control group.

Various data exist in the literature on the content of chromium in human blood and its distribution between plasma and erythrocytes. It is known that the concentration of chromium in the organism of people, unlike the other elements, decreases with age. However, having studied the content of chromium in the whole blood by the method of quantitative spectral analysis at a parallel study with atomic absorption method, we found a higher concentration of this element in the control group and the examined workers, compared with the present standard for whole blood — 4.7 mg/dl. [20]. Biological role of chromium is studied very poorly. Is not known, does any organ fulfill specific function of the accumulation and release of «metabolically reactive» chromium. According to the definition «metabolically reactive» chrome of blood is the fraction, the concentration of which is growing rapidly in response to elevated levels of glucose and insulin. It is believed that this additional release of chromium is reacted with an increased amount of insulin secreted in response to glucose, and enhances the action of the hormone on insulin receptors of cells which are sensitive to insulin. At the same time, taking into consideration the structure of the atom of chromium, its close position in the periodic table of elements to such element as manganese (its biological activity is examined more) it gives reason to believe that chromium is not indifferent and plays some certain role in the life of manganese as it is known that chromium relates to metals with mixed valence, particularly active in complexation. Watching high levels of chromium in the blood of the control group and examined the underground workers we can assume that there is biochemical process which is closely linked with the place of residence, i.e. biogeochemical province is forming and chromium from environmental objects comes into the chain soil-water-plant — a man.

Manganese with optimum dose affects the absorption of copper in the body; it can form complexes with copper and make it unavailable to the organism. That may lead to a decrease of concentration in the blood that we observe in the studied groups. A study of the control group and the workers, in particular drivers of scraper hoist revealed reduction of zinc in the blood within the lower limit of norm of set values (100 to 680 mg/dl).

Thus, the studied workers have marked changes of microelement spectrum of blood. It is manifested in the accumulation of chromium in the blood, which can be a factor of «risk» in violation of the health of workers. The accumulation of chromium among the studied individuals is apparently associated with living in the conditions of technogenic biogeochemical province.

Extensive epidemiological studies are conducted around the world to assess the impact of adverse environmental factors on the health of population. One of the criteria of these researches was to determine the levels of metals in biological substrates of the population. In Kazakhstan, work on the study of metal contamination of environmental objects is held for a long time and it usually deals with inspection of industries related to working conditions in the workplace. Work on survey of child population was not carried out. Thus, the problem of determining the concentrations of metals in biological material among children and non-professional population in Kazakhstan is radically new.

Therefore, we analyzed the number of research papers studying the content of metals in biological environments of children living in areas with varying degrees of environmental well-being.

The content of lead in the soil generally ranges from 0.1 to 20 mg / kg. Lead negatively affects the biological activity in the soil, inhibits the activity of the enzymes decreasing the emission of carbon dioxide and the number of microorganisms. Lead accumulates in the earth's crust not only due to its melting out of mantle, but also as a result of radioactive decay of isotopes of uranium (^{238}U, ^{235}U) and thorium (^{232}Th). The weathering of rocks makes the cations of lead release, most of them are absorbed by highly dispersed clay particles and hydroxides of iron, and less goes into the ground water. As part of the sediment, as well as in the form of organic compounds, simple and complex ions the lead is removed with river flow and deposited mainly in the deltas and narrow coastal strip of the shelf. A small amount of lead that enters the ocean precipitates through biofiltration of sea water by the organisms of plankton. Thus, the ocean is the global accumulator of soluble forms of lead.

On land the lead is absorbed by plants. During the fires a considerable mass of element enters the atmosphere (in the form of smoke). In addition, lead is contained in the highly-dispersive mineral dust. «Lifetime» of lead-containing aerosols is about 7 days.

Annual production of lead significantly exceeds the removal of soluble forms and annual vegetation capture of this element. Technogenic scattering of lead, in contrast to the scattering of gaseous substances, does not cover large areas. It is mainly concentrated along highways, which is connected with the use of tetraethyl lead as antidetonator of motor gasoline.

There are many mineral deposits, rich in lead, and the metal is easily released from the minerals. In total there are more than one hundred lead minerals. The main of them are — galena (lead glance) PbS and products of its chemical transformations — anglesite (lead spar) $PbSO_4$ and cerussite («white lead ore») $PbCO_3$. Less common are: pyromorphite («green lead ore») $PbCl_2 \cdot 3Pb_3(PO_4)_2$, mimetite $PbCl_2 \cdot 3Pb_3(AsO_4)_2$, crocoite («red lead ore») $PbCrO_4$, wulfenite («yellow lead ore») $PbMoO_4$, stolzite $PbWO_4$. The lead ores often also have other metals — copper, zinc, cadmium, silver, gold, bismuth and etc. The soil, plants and water deposited by lead ores enriched with this element (up to 1 % Pb).

The enrichment of lead ores consists of such steps as dry grinding, wet grinding, screening, enrichment on concentration tables and flotation. Methods of grinding depend on the ore characteristics. Before pulverizing ore gravity separation is carried out. It gives raw concentrate of galena which is suitable for further enrichment and separation from minerals of zinc by flotation method. (Flotation method was originally developed just for this.) The finely pulverized ore is poured with water, and the mixture is stirred with compressed air in the tank with adding to it a small amount of certain chemicals and pine oil (turpentine). Galena foam is formed on the surface and waste rock settles to the bottom. Foam is discharged from the tank and dried.

Lead and other metals, if they are present, are converted to the oxides forming sulfur dioxide. To suppress the growth of the accretion of iron oxide (on the walls of the mine) and to form slag we add flux — usually dust-like high silica rock (instead of it we can add powdered limestone or dolomite). The most advanced technology of direct smelting in flash roasting furnace is the process of oxygenic weighted electrothermal smelting of lead and zinc concentrates (OWETS LZC), developed in the Soviet Union. The largest furnace of such type in the West works since 1987 in Porto Vesma on the island of Sardinia. Initially, the process of OWETS LZC was developed as the technology to smelt a mixture of bulk concentrates of various ores in a cyclone. A typical furnace of such kind can melt 120–130 thousands of tones of concentrate a year with loading about 600 tons per day and produce 80–90 thousand of tons of crude lead per year containing up to 97 % of lead.

A significant increase in the content of Pb in the environment is associated with the coal burning, the use of tetraethyl lead in motor fuel, as well as waste water of ore-dressing, some metallurgical and chemical industries. The groundwater lead concentrations rarely reach several tens of mg/l. The acidic waters of ore it is tens to hundreds of mg/l, only chloride thermal water sometimes reaches a few mg/l. Pb is highly toxic, it is accumulated in the bones, liver, and kidneys. MPC of lead for drinking water is 0.03 mg/l.

Lead is mainly used in the manufacture of car batteries and addictive agents of tetraethyl of lead for gasoline (in recent years the use of toxic lead additives is reduced due to the restrictions on the use of ethylated gasoline). About a quarter of produced lead is spent on the needs of building, communication, electrical, technical and electronic industry, manufacture of armament, dyes (white lead paint, red lead and others), lead glass and crystal and ceramic glaze. In addition, lead is used in the ceramic industry to produce typographic fonts, in antifriction alloys as ballast loads or weights; tubes and containers for radioactive materials are made of it. Lead is the basic material for protection against ionizing radiation. Most part of the lead is reused (exception is glass and ceramic products, chemicals and pigments). Therefore, the need for lead can be covered to a large extent due to the processing of scrap metal.

Lead enters the body via the gastrointestinal tract or the respiratory system, and then it is carried by the blood throughout the body. And inhaling lead dust is much more dangerous than the presence of it in food. The city air lead levels on average are from 0.15 up to 0.5 mcg/m^3. Areas with ore processing enterprises the concentration is higher [21].

Lead is a toxic metal. It refers to conditionally essential elements. It is a part of a highly specialized group of elements that «works» not with all species of organisms. Lead is a biogenic element.

Lead is accumulated in the bones, partially replacing calcium in phosphate $Ca_3(PO_4)_2$. When it penetrates soft tissues — muscles, liver, kidneys, brain, lymph nodes, lead causes disease called plumbism. Like many other heavy metals, lead (in form of ions) blocks the activity of certain enzymes. It has been found that their activity is reduced for 100 times with increased concentration of lead in blood for 10 times — from 10

up to 100 micrograms per 100 ml of blood. It causes anemia; hematopoietic system, kidneys and brain are damaged; intelligence is reduced. Sign of chronic poisoning is gray border on the gums, a disorder of the nervous system. Lead is especially dangerous for children, because it causes a delay in development. At the same time, tens of millions of children worldwide under the age of 6 have lead poisoning; the main reason is when the paint containing lead gets into the mouth. Antidote can be calcium salt of ethylene diamine tetracidic acid. Inside the poisoned body calcium is substituted by ions of lead, which are held in this salt very durable and are displayed in this form.

Lead can be easily ingested by drinking water, if it was in contact with the metal: in the presence of carbon dioxide the soluble hydrocarbonate $Pb(HCO_3)_2$ is slowly transferred in solution.

Excessive concentrations of metals can cause serious changes in the metabolism and disruption of metabolic processes, thereby reducing non-specific resistance of the organism, leads to disruption of allergic and physical status, and, consequently, to a violation of the functions of various organs and systems. Under the influence of metal hematopoietic process is damaged, which in its turn leads to an increase of immune deficient state in the body.

Under the action of toxic metals in varying degrees, cardiovascular, excretory, digestive, endocrine, immune and hematopoietic systems suffer. However, with all the polymorphism of toxic effects each metal is characterized by the greatest defeat of one of the above mentioned systems.

Lead in contact with the human body interacts with the sulfhydryl groups of proteins and blocks various enzyme systems. Lead is toxic for the central and peripheral nervous system, it is capable of accumulation in the body, especially in bone tissue. Correlation method established the relationship between levels of lead and cadmium in the hair of students and their intellectual development. Lead exposure leads to the defeat of the renal tubules, accompanied by proteinuria and glucosuria. In the future, this leads to a deficiency of vitamin D and parathyroid hormone, to a violation of calcium metabolism in the body and causes the subsequent systemic lesion of bone tissue — osteoporosis and osteomalacia. There is evidence that an imbalance of lead in the body can predict tumor cell growth.

It was revealed that the concentration of lead and copper varies in a narrow range of from 2.6 to 5,2 mcg/g and from 10.1 to 14, 1 mcg/g respectively. Zinc has the following limit of variability — 91.7 up to 147 mcg/g. In the available literature there are data on content of lead, copper and cadmium in the hair of children living in ecologically-poor areas.

It is educed by us the concentration of lead in the hair of children in Karaganda is almost equal to the concentration of lead in the hair of children in Saint-Petersburg, which are part of the risk group of the city. The content of zinc and copper in the hair of Karaganda children living in the industrial area is increased for 1.5 and 1.6 times respectively, in comparison with a relatively clean area of the city. The question of the natural content of lead and other metals in biological material is a subject of dispute at the present time. It is considered that considers the physiological norm of lead in the hair of children of preschool ge as 9.8 mcg/g. The literature cited as a physiological norm of lead and other amount — 2 mcg/g. World organization IAEA offers the amount equal to 9.17 mcg/g. WHO recommends the allowable concentration of lead in the hair up to 8 mcg/g. It's hard to say what number is more accurate and whether it is justified.

According to the results of work contained in the summary report of the international group of experts (WHO), the most informative bio-substrate at lead action is blood.

According to the literature, the natural content of lead in blood of children must be a concentration within the 10–20 mcg/dl. According to American doctors, the content of lead in children's blood should not exceed 30 mcg/dl; according to Russian researchers the average content of lead in children's blood for cities with low levels of lead in the environment is close to the 10 mcg/dl. In a city with high levels of lead in the environment, this level may be exceeded by almost half and is 18,9 mcg/dl. The content of manganese in the blood is quite different, and allowed up to 4 mcg/dl. But the number of 0.05 to 0.8 mcg/dl is considered as a natural concentration in blood. The manganese content in the blood of Karaganda children is within the physiological values. If we take into account the proposed reference limits of zinc and copper in the blood of children established by the countries of the European Community then the content of zinc in the blood of the investigated children is higher by almost 2.5 times, and the concentration of copper in the blood is reduced by 2 times.

Elimination is the final step of metal toxicokinetics in the body and carries specific information on possible factors affecting toxicokinetic processes in the body, regardless of the level and routes of metal penetration. The excretion with the urine can serve as a good diagnostic test of their effects on the body. The established increase of urinary excretion of zinc and copper for 4 times, and lead for 3.6 times.

In spite of the fact that on an environment and health of population plenty of works is devoted the study of influence of heavy metals, however, many information of protivorechivye and require further more careful study.

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Ауыр металдардың қоршаған ортаға және халықтың денсаулығына әсері

Мақалада қоршаған ортаға және адам ағзасына ауыр металдардың әсері туралы әдебиеттерге шолу жүргізілді. Ауыр металдар өндіріс қалалардың қоршаған ортасының негізгі ластаушылары болып табылады. Ауыр металдардың қосындылары жоғарғы биохимиялық белсенділігімен, яғни қоршаған ортада және тірі ағзаларда жинақталуымен сипатталады. Биологиялық реакциялардың катализатор ретінде микроэлементтердің маңызды рөлі және адам ағзасына ауыр металдардың әсері анықталды. Қоршаған ортаға ауыр металдардың түсу жолдарының негізгі көзі — өндіріс өнеркәсіптер және көліктердің шығарындылары. Қоршаған ортада ауыр металдардың жоғарғы концентрациялары ағзаның бейімделу реакциясының төмендеуіне және аурулардың дамуына әкеледі.

М.А.Мукашева, Ш.М.Нугуманова, Д.В.Суржиков

Влияние тяжелых металлов на окружающую среду и здоровье населения

Дан литературный анализ влияния тяжелых металлов на окружающую среду и организм человека. Тяжелые металлы являются основными загрязнителями окружающей среды промышленных городов. Соединения тяжелых металлов обладают высокой биохимической активностью, способностью накапливаться в окружающей среде и живых организмах. Выявлены важная роль микроэлементов как катализаторов многих биологических реакций и патогенное влияние тяжелых металлов на организм человека. Основными источниками поступления тяжелых металлов в окружающую среду являются выбросы промышленных предприятий и выхлопы автомобильного транспорта. Высокие концентрации тяжелых металлов в окружающую среду могут привести к снижению приспособительных реакций организма и развитию болезненных состояний.

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Généalogie particulier les jumeaux sont nés grâce àfécondation in vitro dans les grossesses multiples

L' article est consacré aux caractéristiques généalogiques des jumeaux, l'utilisation des technologies de reproduction supplémentaires dans la naissance des «enfants de tube à essai « à la suite de la fécondation in vitro dans les grossesses multiples. Elle a révélé la croissance des maladies pathologiques chez les femmes et les hommes, et l'un des problèmes d'infertilité. Avec l'aide de la FIV il ya une chance de devenir parents de jumeaux, ainsi que les grossesses multiples. Il a également été pris comme base, la description et le contraste des jumeaux, la fécondation multiple. A révélé que entre les jumeaux qui sont nés grâce à la fécondation multiple, et ceux qui sont nés naturellement il ya des différences dans les paramètres.

Mots-clés: la fécondation in vitro (FIV), les technologies de reproduction, «bébés éprouvette», caractéristiques généalogiques.

Dans notre pays compte aujourd'hui 13 centres de fécondation in vitro (FIV). Parmi ceux-ci, trois public et le reste privée. Au Kazakhstan, le vitro centre de fécondation a ouvert en 1995, et aujourd'hui sont nés plus de six millions d' enfants «bébés éprouvette». Grossesse multiple est inhabituelle de la personne et le nombre de complications sont à risque pour le fœtus et pour le corps de la mère. Causes de jumeaux ne sont pas exactement connu, cependant, est censé influencer l'élément de l'hérédité, en particulier côté de la mère, qui est associée à des niveaux élevés d'hormones sexuelles. Le débit d'une grossesse multiple différent d'un singleton complications plus fréquentes typiques: anémie, gestose, livraison de prezhdevremknnye, de présentation et de décollement prématuré du placenta, position anormale du fœtus et du placenta praevia, une insuffisance placentaire, retard de croissance intra-utérine et dissocié développement du fœtus, les malformations congénitales du fœtus. Il est à noter, la grossesse multiple d'ordre supérieur, plus le risque de complications maternelles. Dans le premier trimestre de 15–20 % observé phénomène de «dépérissement de l'une des oeufs fœtales». Par conséquent, si vous êtes diagnostiqué avec un jumeau ou triplet, il est possible que le développement aura un seul fœtus.

Dans le deuxième et troisième trimestre de complications les plus fréquentes sont la menace de résiliation et les fausses couches, qui se produisent chaque seconde enceinte de jumeaux. Par conséquent, enceinte de jumeaux, et beaucoup de fruits ont à prendre des médicaments relaxants l'utérus. Souvent, pour préserver la grossesse en grossesse multiple ont à un long traitement dans un hôpital de maternité. Lorsque plusieurs grossesses chez les femmes, il est deux fois la charge sur le système cardio-vasculaire, qui peut conduire à une violation de sa fonction et de décompensation. Une expression fonctionnelle état de contrainte [1].

Ainsi le volume de sang a augmenté d'environ 20 % par rapport à une grossesse singleton, il ya une augmentation dans le nombre d'érythrocytes, le débit cardiaque, la pression artérielle diastolique et le taux de filtration glomérulaire rénale. L'anémie chez la mère pendant la grossesse avec des jumeaux est considérée comme une complication fréquente.

En cas de grossesse multiple est une augmentation de la masse de tissu placentaire et augmente la teneur de facteurs placentaires provoquant une anémie. Il se trouve que, dans une grossesse gémellaire il ya une augmentation du volume intravasculaire, réduisant ainsi le taux d'hémoglobine, hématocrite, en particulier pendant le deuxième trimestre de la grossesse.

Tous les auteurs ont une incidence élevée de la fin prématurée de la grossesse de 26 % à 90 %. Selon l'hypothèse commune traditionnelle, la principale cause d'accouchement prématuré est hyperextension des fibres musculaires de l'utérus, en raison de la grande quantité de fruits.

Près des 2/3 des nouveau-nés décédés après les naissances multiples sont nés prématurément. Lorsque grossesse multiple marquée par la fréquence élevée de la fin prématurée de la grossesse, lors d'un double de 26 % à 56 %, dans un trois — 66–97 % avec des quadruplés — plus de 90 % [2].

Lorsque les grossesses multiples sont les malformations congénitales les plus courantes, comptant pour 2,7 % à la double, de 6,1 % pour des triplés. Si malformations singleton de grossesse surviennent dans 1,4 %.

Les malformations les plus courantes chez les jumeaux ont l'emplacement suivant: le système cardiovasculaire, tractus gastro-intestinal, du moins — le système nerveux central, poumons, le système musculo-squelettique et système urogénital [3].

Lorsque plusieurs naissances de grossesse se produisent plus tôt que dans singleton. Juste noter que la grossesse multiple se produit une maturation plus précoce des poumons, ce qui permet les nouveau-nés prématurés, à respirer de façon autonome. Il a été constaté que le moins de complications périnatales et de la période la plus favorable pour la naissance de jumeaux est 36–38 semaines de grossesse, dans un délai de livraison de trois optimale est 34–36 semaines.

Enfants jumeaux naissent très différent, avec des caractéristiques spécifiques des particuliers dans la structure et le fonctionnement de l'organisme et de ses systèmes individuels. En règle générale, enceinte de jumeaux est plus grave, une femme éprouve souvent des nausées matinales, souffrant d'hypertension. Lits grossesse grossesses plus courte de l'enfant, les jumeaux sont souvent nés prématurément et moins mature. En outre, les livraisons sont eux-mêmes souvent des complications.

En raison de tout cela, les enfants peuvent prendre du retard dans le développement de leurs pairs. Ils commencent plus tard pour garder votre tête, s'asseoir, marcher. Dans la petite enfance, ils tombent malades plus souvent et sont donc plus faible physiquement. Le carnet de commandes de jumeaux se manifeste non seulement dans le physique, mais aussi la sphère mentale. Donc, ils commencent à parler plus tard, ont souvent des performances intellectuel inférieur. Il joue un rôle important d'insuffisance pondérale à la naissance et à la double léger IQ souvent plus faible. Bien sûr, les conséquences du développement du fœtus complexe lissées pendant la petite enfance. Beaucoup des jumeaux au début de l'âge de l'école, ils disparaissent entièrement, mais certains restent [4].

Twins vie la vie des enfants caractérisé en ce que deux enfants sont au même stade de développement physique et mental, est en communication constante avec l'autre, ils sont une expérience presque identique est, avant tout, une situation sociale unique. Nous croyons que les conditions particulières de la psyché de jumeaux sont déterminées essentiellement le développement prénatal; Twins relations avec l'autre, l'attitude des gens autour des jumeaux et, surtout, l' attitude à leur égard de leurs parents.

Dans les études de la parole de jumeaux à l'origine posé le problème de trouver des différences quantitatives statistiquement significatives entre les jumeaux et les enfants. Il a été découvert que les jumeaux derrière pairs seule. Tout d'abord, il est apparu que les jumeaux derrière le vieillissement de la parole. Il est également connu sur les différences de communication dans le calendrier de l'émergence de la parole chez les jumeaux zygotiques et de l'égalité.

Gemini — les enfants nés à la suite d'une grossesse unique. Ils sont identiques et fraternelle, selon la façon dont ils ont évolué à partir d'un seul œuf ou différents. Aussi appelé monozygotes premier, deuxième — les jumeaux dizygotes, et jumeaux, triplés, etc., en fonction de leur nombre. Les différences dans les jumeaux principalement déterminée par trois facteurs: la qualité de l'approvisionnement en sang dans l'utérus, le poids de naissance et l'ordre de naissance.

Selon les relations au sein du couple, les jumeaux sont généralement «tombent» dans l'un des suivants types psychologiques, «étroitement liées», «modérément sensibles» ou «individualistes extrêmes» (Image 1).

Image 1. Les jumeaux fraternels (Saylaukul et Sergazy)

Grossesse multiple — la complication la plus fréquente et grave de la technologie de reproduction assistée (ART). Souvent, beaucoup de stress causé par l'incapacité à tomber enceinte, faire les couples infertiles, et les travailleurs de la santé à oublier que le but de la technologie de reproduction assistée (ART) — non seulement la réalisation de la grossesse, mais aussi la naissance d' enfants en bonne santé.

Dans d'autres nouvelles, sur les préférences des patients ont révélé que plus de 20 % des femmes qui suivent un traitement de l'infertilité, préférerait une grossesse unique multiple. Il est important de noter le fait que 4 % des patients préfèrent une grossesse le résultat le plus désiré. Au vu de ces rapports, il est pas surprenant que les couples subissant une FIV, souvent réclament le transfert de plusieurs embryons. Certains couples croient que, parce qu'ils ont jamais été en mesure de concevoir un enfant, une grossesse multiple ne peut pas avoir peur (Image 2).

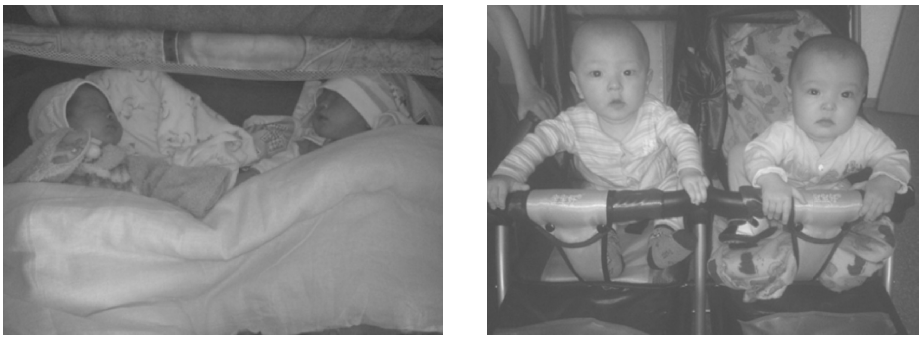

Image 2. 2 paires de jumeaux sont nés dans la même famille dans la ville de Balkhach (Adilzhan et Asylzhan et Alikhan Sezim)

De même, les patients qui ont échoué à tomber enceinte lors du transfert de deux embryons au cours du premier cycle de FIV, ne se calment lorsque vous transférez plusieurs embryons dans le cycle suivant [5].

Ces aspects émotionnels compréhensibles, combinés à des dépenses monétaires considérables nécessaires à la FIV conduisent à plus que ce qu'il devrait être, le nombre de grossesses multiples dans ce pays. Poursuite du renforcement de cette tendance est en fait une pression sur le programme de FIV avec les exigences de la promulgation des taux de réussite élevés afin de maintenir la compétitivité.

Arbre généalogique — une représentation schématique des liens familiaux dans la forme d'un arbre, qui est à la racine du fondateur, et les branches d'un arbre — différentes lignes de ses descendants. Arbre généalogique est aussi appelé la présentation des pedigrees comme ascendant ou descendant tables genalogicheskih [6].

Il existe plusieurs variétés de la méthode double. La préoccupation la plus commune et fondamentale:

1) Méthode de jumeaux classique;

2) la méthode de jumeaux séparés;

3) la méthode de familles jumeaux.

Comme une capacité héréditaire à giperovulyatsii les femmes et la capacité des hommes mener une enzyme spéciale dans le sperme, cela signifie qu'il peut être une source de division d'un œuf et la naissance de deux jumeaux identiques ou plus. Il est facile de comprendre pourquoi ce trait peut se manifester «une génération», en fonction de qui hérite de cette capacité: un garçon ou une fille (Image 3).

Image 3.Jumeaux arbre généalogique (Adilzhan et Asylzhan et Alikhan Sezim)

Il devrait néanmoins être dit qu'il ya beaucoup de familles avec plusieurs paires de jumeaux identiques ou fraternels dans la même famille, même jumeaux et des triplés dans une famille. Il ya aussi des familles qui semble avoir la capacité d'apporter les jumeaux est commun entre les générations et les jumeaux sont deux cousins et grand-mère et grand-père, et nièces et neveux.

Rappelez-vous que des antécédents familiaux de jumeaux est seulement un des nombreux facteurs qui influent sur la naissance de jumeaux. Age mère de sa race, poids, l'alimentation, la reproduction et l'histoire jouent un rôle important et il est des cotes comparables avec une histoire de famille [7].

Actuellement, il existe plusieurs théories sur le sujet. L'un des plus réussie, est tout simplement celle qui est due à l'histoire de la famille, qui est l'hérédité: le transfert de gènes giperovulyatsii. Telle est la capacité à mûrir multiples oeufs pendant l'ovulation et cette capacité augmente les chances de concevoir des jumeaux dizygotes (jumeaux). Par exemple, dans les familles où les femmes ont un gène giperovulyatsii leur génétique expliqueraient la forte probabilité de survenue de jumeaux dans la famille. On croit que si la femme elle-même des jumeaux, alors il est 2,5 fois plus de chances de concevoir des jumeaux que toute autre mère. Mère de jumeaux est 3–4 fois plus susceptibles d'avoir une autre paire de jumeaux en plus déjà mère de jumeaux (jumeaux après jumeaux) au cours de leur durée de vie. Cependant, il convient de noter que l'ovulation se produit que chez les femmes. Par conséquent, selon ce point de vue, la possibilité de transférer les jumeaux probablement hérité de la famille par les femmes. Cette théorie la plus acceptée suppose toutefois que l'homme, mais de fournir le sperme, tandis qu'une femme ovule deux œufs, ne dépend pas de quoi que ce soit. Plus précisément, l'homme peut porter ce gène, mais il est manifeste si elle serait ma fille.

T a b l e

Ans	Grossesse multiple, %
2009	12,5
2010	26,2
2011	25,1
2012	27,3

Méthodes de traitement de l'infertilité, en particulier les techniques de reproduction assistée (ART), ont un impact énorme sur le nombre de grossesses multiples. Malgré le fait que, par suite de la technologie de reproduction assistée (ART) est né seulement 0,4 % des naissances vivantes, elles deviennent une cause de la naissance de 13,9 % et 41,8 % des jumeaux naissance 3 ou plus de fruits. La naissance de jumeaux est associée à un certain nombre de problèmes médicaux.

Application des méthodes de technologie de reproduction assistée (ART) augmente le risque de naissance de deux jumeaux monozygotes et hétérozygotes, et 3 ou plus des jumeaux. Induction de l'ovulation augmente naissances jumeaux monozygotes à 1,2 % comparativement à 0,4 % des naissances (Table).

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З.Т.Кыстаубаева, С.Елюбай, А.Т.Серікбай

Экстракорпоральды ұрықтандыру нәтижесіндегі көпұрықты жүктіліктен дүниеге келген егіздердің генеалогиялық ерекшеліктері

Мақалада қазіргі таңдағы өзекті мәселелердің бірі — экстракорпоральды ұрықтандыру (ЭҚҰ) нәтижесінде «түтікшелік нәресте» дүниеге келуі, сонымен қатар көпұрықты жүктілік нәтижесінде дүниеге келген егіздердің генеалогиялық ерекшеліктері сипатталған. Демек, ЭКҰ арқылы егіздердің ата-анасы болу, сонымен қатар көпұрықты жүктіліктің нәтижелі болуы, оның жүзеге асуы, дамуы жүзеге асып отыр. Сонымен қатар көпұрықты ұрықтандыру нәтижесіндегі егіздердің даму сипаттамасы мен ерекшеліктері негізге алынған. Жасанды жолмен ұрықтандыру мен табиғи жолмен дүниеге келетін егіздерді салыстырғанда әр түрлі көрсеткіштері мен айырмашылықтары бар екені көрсетілген.

З.Т.Кыстаубаева, С.Елюбай, А.Т.Серикбай

Генеалогические особенности близнецов, появившихся на свет путем экстракорпорального оплодотворения при многоплодной беременности

Статья посвящена использованию дополнительных репродуктивных технологий в рождении «пробирочных детей» в результате экстракорпорального оплодотворения при многоплодной беременности. Выявлен рост патологических заболеваний среди женщин и мужчин — как одна из проблем бесплодия. С помощью ЭКО есть вероятная возможность стать родителями близнецов, так же как и многоплодной беременности. За основу были взяты описание и отличие развития близнецов многоплодного оплодотворения. Выявлено, что между близнецами, которые появились на свет благодаря многоплодному оплодотворению, и теми, которые родились естественным путем, есть разница в параметрах.

Z.T.Kystaubaeva, S.Eliby, A.T.Serikbay

Genealogical especially twins were born by in vitro fertilization in multiple pregnancies

The article is devoted to genealogical characteristics of the twins , the use of additional reproductive technologies in the birth of «test tube children» as a result of in vitro fertilization in multiple pregnancies. It revealed the growth of pathological diseases among women and men, and one of the problems of infertility. With ECO there likely to become parents of twins, as well as multiple pregnancies. There have also been taken as a basis for the description of the difference between the twins and development prolific fertilization. Revealed that between the twins , who were born thanks to the multiple fertilization and those who were born naturally have differences in the parameters.

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Assessment of schoolchildren functional shifts in a polluted air

Environmental pollution has an adverse effect on the functional state of the body of the child population. Exposure to environmental factors leads to the development of negative effects in the health status of the population, which translates into an increase in the incidence and deterioration of physical development. The unfavorable environment adversely affects the level of physical development and functional state in children, causing a high level of functional tension. The process of adaptation of schoolchildren living in different ecological zones of well-being, accompanied by a decrease in performance. Functional stress in children living in contaminated areas in line with the levels of pronounced stress and overexertion. The incidence of schoolchildren living in areas contaminated area reflected the reduced level of resistance of the body and testified about the negative impact neblagorpiyatnyh factors on the adaptive activity of the organism adolescents.

Key words: assessment, influence, environment, weight, growth, health, harmony, pollution, factors.

The schoolchildren health monitoring is the basis for preventive and promotive activities in school. Features of the health status of different age groups pupils, the deviation from the norm most frequently detected by their, factors affecting their formation, methods of prevention should be good to know for clear and proper organization of the work.

The nature of deviations in the physical condition of modern schoolchildren depends on many factors. Radical changes in population lifestyle, caused by scientific and technological progress have not only positive but also negative aspects. Specificity of life rhythm in big cities, the rapid growth of the information flow, low physical activity, large total academic load, the violation of the day regime, mainly the action of negative environmental factors contribute to formation the number of deviations [1].

Therefore, a deeper study of the health status of teenagers living in different areas of ecological trouble, in the period of study at the secondary school has a special interest.

Materials and methods

The object of the study were schoolchildren of secondary schools in Karaganda. Two groups were identified. The main group of children living in the Oktyabrsky district, where is the industrial enterprises complex. The region arbitrarily identified as «dirty» area. The control group of children living in areas of the South-East, where there is no industry. This region was conditionally identified as «clean» area [2]. In addition the children were divided by age: 7–9 years, 10–13 years and 14 years or more, as well as by gender — boys and girls. Percentile method was used to identify the harmony of physical development in children [3].

Express method of assessing the physical condition level of a person carry on the physical condition index [4].

Methodical approach «copy pair» was used because in addition to environmental factors (area of residence), state of physiological parameters depends on the social, economic, biorhythmological and other factors. For each unit of observation in the experimental group were selected similar observation unit in the control (by age, gender, social and living indicators). Thus the area of residence was the only distinctive features for two compared groups.

Measurement of children physical development was carried out using a standard set of common methods [3].

The dynamics of the student organism functional state and the degree of regulatory systems tension during training was assessed by changes in the parameters of the cardiovascular, central and autonomic nervous systems as a sensitive indicator of adaptation using generally accepted techniques. Statistical analysis of the psycho-physiological parameters was performed using standard statistical software package. Sociological research methods were processed by conventional methods to the definition of expectation value, mean square deviation, error of mean and reliability of the differences (by Student's).

Results and Discussion

Children population health is formed under influence a complex set of biological, ecological and social factors. Physical development of children and adolescents, which characterizes the process of growth and maturation of the growing organism, is a leading criterion of population health. It allows to predict the viability of the country's adult population [5].

General dynamics of anthropological indicators were relevant to the age peculiarities. However, credible differences between growth and weights pupils according to their age limits, depending on the environmental conditions at the residence place were found. Moreover, this trend was not in favor of children living in the environmental stress area.

By centile assessment of schoolchildren physical development of studied groups (Fig. 1) more expressed differences were noted among boys of the second age group (10–13 years), and the girls in the first age group (7–9 years).

Integral values that characterize index of the physical state may be a further confirmation of the negative impact of unfavorable ecological situation in the students physical development.

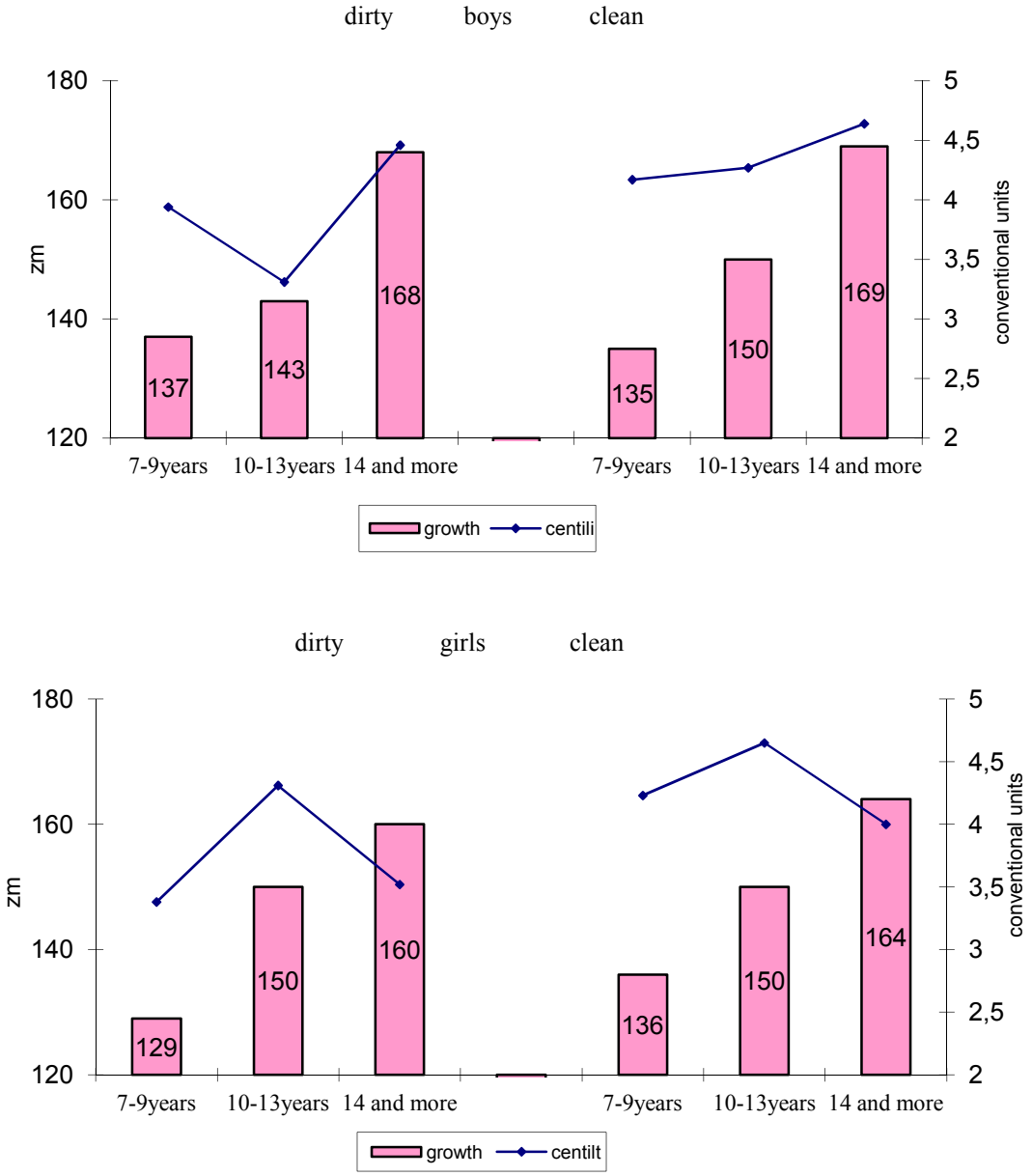

Figure 1. Dynamics of growth and centile growth of schoolchildren according to gender, age and residence place

The boys of both groups of all ages corresponded to the «average» level (0.53±0.68 standard units), while the girls «dirty» area corresponded to the «medium» level and «clean» area — the level «above average» in accordance with the gradation of physical condition index (Fig. 2). Despite the fact that the group fell in different ranges of quantitative gradation under the graduation, significant differences were observed only in the second age group of boys and girls only in the first age group pp<0.05). Large values, and consequently the positive in the physiological sense, noted in «clean» area.

No significant differences according to sex and age from the muscle strength is not revealed, except two boys age group, where the figure was significantly higher among schoolchildren living in the zone of relative environmental well-being (19.4±0.02 kg in the «dirty» area and 22.3±0.92 kg in the «clean») (p<0.05). In general, the dynamics of change in muscle strength consist with the age peculiarities of the students organism.

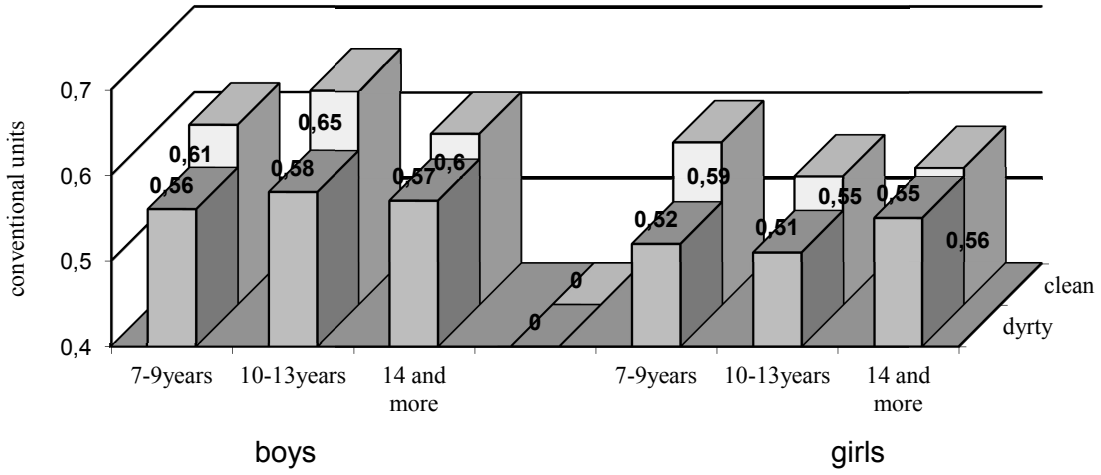

Figure 2. Dynamic of Index of physical condition changes in schoolchildren according

Dynamics of changes in lung capacity is also consistent with the age peculiarities and the differences had the environmental reasons. Significant differences were found in boys of the second age group (10–13 years), where «dirty» area of LC averaged 2223±65.2 ml, while in the «clean» area it already amounted to 2516±95.3 ml (p<0.05).Significant differences were observed among girls in the second and the third age groups. The values of lung capacity were more in the «clean» area.

The results showed that the quality of the environment has a significant influence on the health indicators child's body. At the same time, the leading indicator of the health of schoolchildren is a physical development. The level of this value is closely related to the ecological and socio-hygienic living conditions, it is sublimit to biological laws and reflects the general patterns of growth and development under the environment influence [6–8].

The investigated groups formed on the basis of a copy pair, showed that the mean values of anthropometric indicators of affected area children lower than that of students living in the «clean» area. At the same time, girls than boys are more sensitive to the effects of environmental pollution.

Studies have shown that the ecological situation by place of residence greatly influences on the level of tension systems of the students body.

Significant differences in the age dynamics in children depending on the residence zone were diagnosed by the central nervous system performance. Simple reaction time to visual and auditory stimuli (visual motor reaction and auditory motor reaction) proves this fact (Fig. 3).

Moreover, if the VMR values were higher in students «dirty» areas than in «pure» area, then the AMR differences were diametrically opposed. Significant differences were noted in boys as in AMR, as well as from VMR, the girls only AMR. The general trend of changes in these indicators was such that as the time of reflex reactions decreases and is more pronounced in children living in the «dirty» area from the side AMR

($p<0.05$). Speed characteristics of nerve impulse flow regulation in the subcortical level indicate a high rate of processes that provide motor activity of schoolchildren living in the «clean» area.

Significant differences were found from the side blood pressure and high values of systolic blood pressure (SBP) and diastolic blood pressure (DBP) were noted in school «dirty» areas, although not all of these differences were significant.

For example, significant differences SBP in boys were found in 3 age group (14–16 years), DBP — in the first (7–9 years).

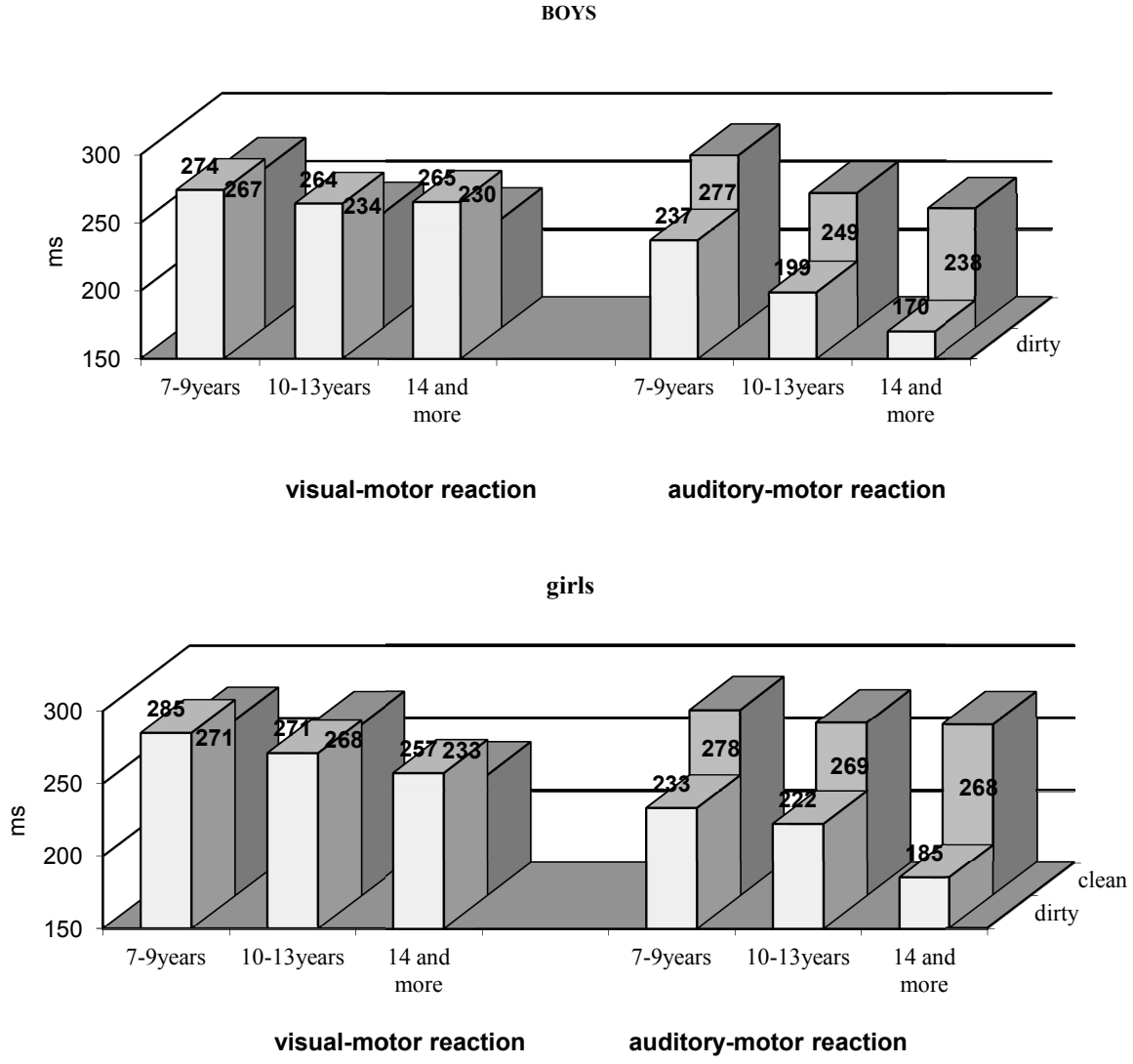

Figure 3. Dynamics of reflex reactions among schoolchildren, depending on residence area

Significant SBP differences in girls were observed in 1 and 3 age groups, DBP — in the 1st and 2nd. However, all indicators were in the area of age norms, which doesn't show a pronounced negative impact of environmental factors. The high value of SBP were noted in boys third age «dirty» area of 118.5±1.38 mmHg, while in the «clean» the area it was 108.0±1.81 mmHg ($p<0.05$). This is due to the fact that environmental factors play a significant role in the functional status of the individual age groups that have different sensitivity to the impact of negative factors. This is confirmed by V.V.Boldyrev et al. [9], according to which value the contribution of environmental factors in the development of these negative effects is largely dependent on the age of the studied contingent.

No significant differences in heart rate at the school the first age group were noted. In the second age group differences only in girls. And in the third age group, significant differences were found in both groups. Large values of heart rate were noted in «dirty» area schoolchildren. Similar dynamics was observed and

Rufe index, which indicates higher efficiency in schoolchildren living in the zone of ecological well-being. The exceptions were the boys of the first age group for which the index Rufe in «clean» areas were significantly higher than in the «dirty» area. Thus deterioration of the functional state of the cardiovascular system to the standard physical activity in children living in contaminated areas have been identified. Physical performance is included in the concept of the student functional state, it is an integral expression of the body reserve capacity and serves as a reliable test for the evaluation of the cardiorespiratory system functional state in children exposed to adverse environmental conditions at the residence place.

Identified deviations of the organism functional state in schoolchildren from contaminated areas associated with nonspecific action on the body of harmful environmental factors that can be considered expression of protective and compensatory reactions aimed at its optimum adaptation to the environment.

From the analysis of the psychophysiological indicators dynamics it is clear that on the whole the systems adequately respond to emotional stress. But despite this, the different systems have their own characteristics. One such system was central nervous system. The results showed that the degree of central nervous system expressiveness response to examination stress is directly dependent on the environmental conditions at the place of schoolchildren residence, however, this was not always significant differences.

The ecological situation by place of residence is reflected in the dynamics of the critical fusion frequency (CFF) during the exam, and these differences have not had negative connotation.CFF values were higher in schoolchildren living in the «dirty» area than «clean» area, that is adaptive capacity to the effects of stress factors in schoolchildren «dirty» area is above.

Studies in the groups formed on the principle of the copy-pair indicate that girls more sensitive to the effects of environmental pollution than boys. Analysis of morbidity showed that children living in areas of ecological trouble, it was 28.7 % were infected to 71.3 % not infected, in the «clean» area was 20.4 % to 79.6 % (Fig. 4).

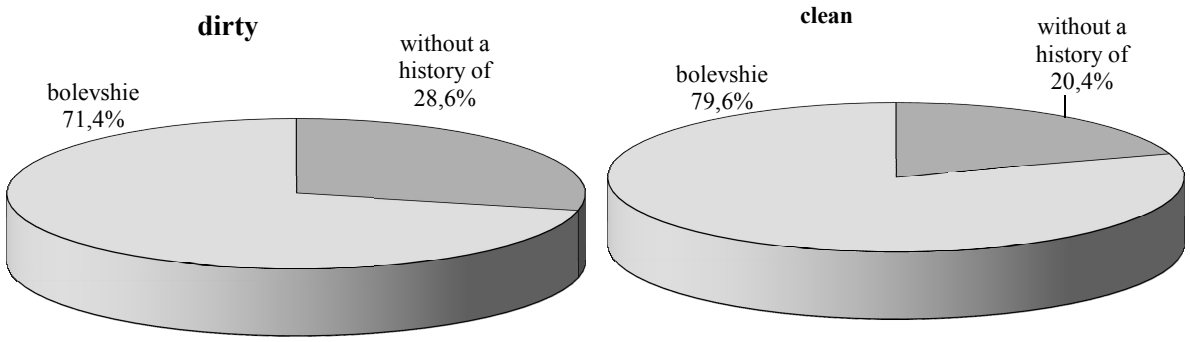

Figure 4. Proportion of children infected and not infected, depending on the residence

It was revealed that all morbidity indicators of children living in the zone of ecological trouble reflect the overall reduced level of students organism resistance. This is evidenced by such indicator as a health index, which reflects the ratio of never uninfected children to the population size for the year. Health Index in the «dirty» area was lower than in «clean». The gender and age characteristics affect the health index difference.

Contamination of the environment has a direct effect on the functional status of schoolchildren to a lesser degree, but can be considered as the initial cause of reduced organism resistance, morphological and functional disorders systems. Moreover, environmental factors can exacerbate the effects of other risk factors, since superimposed on the other factors, including environmental, can under certain conditions cause the launch of pathological processes in the child body. This is confirmed by the results O.V.Tulyakova, M.S.Andreev [10] have established correlation between respiratory disease and the degree of air pollution by harmful substances.

Correlation analysis showed that the level of the schoolchildren functional state depends largely on the age, anthropometric indicators, as well as their derivatives settlement — the index of the physical condition and the adaptive capacity. At the same time the differences among schoolchildren, depending on the degree of ecological trouble by residence place are clearly visible. Thus, no significant differences in age and height

in the studied groups were noted (mean percentage contribution to total dispersion was 17.0–18.2 %). However, differences were noted in other factors, the more pronounced in derivatives settlement — the physical condition index and the adaptive capacity.

Unfavorable environmental situation has a negative effect on physiological indicators and «quality» of the child population health. The degree of energy reserves mobilization is higher in schoolchildren residing in the zone of ecological trouble. The most pronounced differences were noted among schoolchildren in the third age period of 14–16 years.

It was found that children living in the zone of ecological distress have indexes of morbidity that reflect the generally low level of resistance in children. At the same gender and age characteristics influenced at the difference.

Unfavorable ecological situation by residence place greatly affects the schoolchildren body's physical development, it causes stress compensatory-adaptive mechanisms. As a consequence, it is further reflected in the performance and health indicators of the younger generation.

Conclusions

1. Unfavorable ecological situation having a negative impact on the level of physical development, the dynamics of physiological parameters in the process of life. It causes lower performance, high functional stress the cardiovascular system and central nervous system of schoolchildren living in the ecological trouble zone.

2. The process of adaptation to the students' learning, living in different ecological zones of well-being, followed by periods of tension expressed in the cardiovascular system functional state. Functional stress in «dirty» area correspond to the level of pronounced tension and overvoltages, in «clean» it was pronounced stress.

3. Morbidity with temporary disability schoolchildren living in the area «of ecological trouble» reflect the overall low level of body resistance, compared to the control. It shows a pronounced negative impact of environmental factors on the adaptive capacity of the organism teenagers to habitat conditions.

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Ш.М.Нугуманова, А.М.Олещенко, А.Г.Проженик

Атмосфералық ауаның ластану жағдайында оқушылар ағзасының функционалдық ауытқуларына баға беру

Мақалада қоршаған ортаның ластануы балалар ағзасының функционалдық жағдайына жағымсыз әсерін тигізеді. Қоршаған ортаның жағымсыз жағдайлары тұрғындар денсаулығына зиян келтіріп, аурушандық деңгейін жоғарлатады, балалардың физикалық дамуын тежейді. Қоршаған ортаның зиянды факторлары балалар ағзасының функционалдық жағдайына, функционалдық ширығуының жоғарғы деңгейде болуына әкеледі. Авторлар әр түрлі экологиялық аймақта мекендейтін оқушылардың бейімделу үрдісі жұмысқа қабілеттілігі төмендететінін анықтаған. Лас ауданда тұратын оқушылардың функционалдық ширығуы жоғары деңгейде болды. Оқушылардың аурушандық көрсеткіштері бойынша лас аудандарда тұратындарда ағзаның ауруларға қарсы тұру деңгейі төмен, яғни, жағымсыз экологиялық факторлар балалардың бейімделу әрекеттеріне кері әсерін тигізетіндігі дәлелденген.

Ш.М.Нугуманова, А.М.Олещенко, А.Г.Проженик

Оценка функциональных сдвигов у школьников в условиях загрязненного атмосферного воздуха

В статье отмечено, что неблагоприятная окружающая среда негативно сказывается на уровне физического развития и функциональном состоянии организма детей, обусловливая высокую степень их функционального напряжения. Показано, что процесс адаптации у школьников, проживающих в различных по экологическому благополучию зонах, сопровождается снижением работоспособности. Функциональное напряжение организма детей, проживающих в загрязненном районе, по данным авторов, соответствовало уровням резко выраженного напряжения и перенапряжения. Доказано, что показатели заболеваемости школьников, проживающих в зоне загрязненного района, отражали пониженный уровень сопротивляемости их организма и свидетельствовали о негативном влиянии неблагоприятных факторов на приспособительную деятельность организма подростков.

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The effect of use of mobile communications to the human body

This article contains information about the impact of mobile communicationson the human body. And also it considers the harmful of mobile phones to the human health. It is clear that electromagnetic radiation from mobile phones has a negative impact on the physiological state and psyche of the person. Not following the rulesof using of mobile phones are doing a lot of damage to the health of people.

Key words: mobile phone, pupils, burden and hazards, eye disease, respiratory disease, musculoskeletal disease, nerve disease.

The development of science and technology of the 21st century, information breakthrough is certainly a result of the prosperity of particular human thinking.

On the one hand this saves golden time of people reducing their work, but on the other hand it has a negative impact on their health [1].

We know that today all the modern people have mobile phones in their pockets. The mobile phone has now become a familiar household of each person which is used in everyday life. Mobile phone is so developed that we can say that no one can go without it. It is true that it has everything that we need [2]. For example: a clock, calendar, calculator, take a picture or record a video, record a song that you want, remember, listen and others. You cannot really solve anything without the help of this little substance. With the help of it, you can find the person you need without searching through the city. It has become necessary object for people when they are at work, at school or wherever they are, but the mobile phone is not only useful for human but we should not forget that there is a danger [3]. That's why I chose this topic for the analysis of very interesting question but the mobile phone is not only in favor of the health of the people, must not forget that there are dangers. That's why I chose this topic for analyzing; it is a very interesting problem.

Mobile phone is the most advanced and available form of wireless communication. 5–6 years ago, the mobile phones were in people who have important jobs, but now almost every person has it [4]. Even now, just crossed the thresholds of the school pupils have the phones of latest and valuable brand. Parents buy mobile phones for their children to know where their children are. People not only talk by the phone and they also use calendar, alarm clock, reminder, clock, and so on in it [5]. Experts are alarmed that in the next 10–15 years because of the harm wireless phone number of people with cancer will increase. This year, the World Health Organization has announced that mobile phones are harmful to the health of the young generation. Scientists believe that talking on a cell phone for half an hour a day for 10 years will increase the risk of contracting the disease of glioma up to 40 percent. So it is clear that mobile phone is main mechanism of electromagnetic radiation [6].

They are the radiation affecting on the complication of diseases such as nervous, endocrine and venereal diseases. Even in some countries, children of school age are forbidden to carry mobile phones [7–10].

Because children who regularly use mobile phones from the age 10–11 years there is a probability of occurrence of brain tumors. Because electromagnetic radiation penetrates into the central nervous system of the brain that controls thinking. Experts do not conceal that the main cause of complications of epilepsy, psychiatric disease, blood disease is a wireless phone. Worldwide comprehensively studied the danger of mobile phones on human life [8–10]. Spanish researchers have proved that children aged 11–13 years, after two minutes of talking on the phone, the bioelectric activity of the brain comes to its former condition for 2 hours. Conducting research scientists in several cities of the UK is also not excluded it. Research conducted by the Institute for Hygiene Russia showed that people aged 20–29 years who used a mobile phone for 5–10 years, have risk of brain tumors. These studies show that how early the younger generation begins to use mobile phones, so increases the risk of disease. However, there are scientists who do not agree with this opinion. Still not fully proved that mobile phones are so affect on the human body. Although various studies carried out in different parts of the world, there are enough people who think that this is an indirect view. According to the words Professor and Dr. Asker Esenkulov, such studies have not proved yet. «Therefore, it

is not necessary to alarm and talk about danger of the mobile phone. It is only a small study.» — he says [11].

Basically, the group which is interested in mobile phones are children and young people. To attract the attention of children, mobile operators offer a variety of games and new services. In 2001 Research Department of the European Parliament forbade the children who are under age, to use of mobile phones. Since then, European countries forbade the students to use of mobile phones. For example, if in the UK on the sale of mobile phones should be brought leaflets informing about their danger, then in France, parents have to monitor how much time their children are talking on the phone [12]. A team of scientists studying the effects of radiation on the human body, supposed to write on the boxes of mobile phones such warnings as «Health Organization warns».

Taking a cue from European countries, in Tajikistan it is forbidden to use of mobile phones for the students of higher and secondary education. However, despite the ban, the main users of mobile phones are children and youth. It's no secret that mobile phones weaken the interests of the school children to the lessons.

In the UK about 20,000 antennas are established only of cellular communication.

However, there is evidence of indirect harm of cellular antennas which are installed in the settlements. According to German scientists protesting the three cellular standards NMT-450, GSM 900 and GSM 1800 (tested directly phones) and 231 pacemakers from different manufacturers, more than 30 % from the pacemaker interfered phones working in the NMT-450 standard and GSM 900. The influence of standard phones GSM 1800 on the work of pacemaker was not detected [13]. In the study was not carried out the measurement of the radiation near the cellular antennas, but it is safe to say that the radiation power of the base station is between 6 and 10 W, in contrast to the tubes, radiating from 0.05 W to 0.6 W. Despite such large tolerances of issues in the security of mobile communication devices the United Kingdom first began to consider the impact of mobile phones on children's health. On the 11.05.2000 it was published the report of group of leading British scientists to study the effects of mobile phones on children's health [14–16]. The report says that children should not use mobile phones because of the greater susceptibility of children’s body to the action of electromagnetic radiation. The study was commissioned by the British government, which immediately reacted to the received report. Ministers got instruction to work out new rules for the use of mobile phones by children, in which it will be pointed the minimum age of users, the maximum duration of talking and the number of possible daily calls. The notice about of possible risk for the child-users of mobile phones has brought in confusion of many mobile phone companies, because they reckoned on the contingent in their business plans. About the most exposure to the radiation of young people says and research, which was held among 11,000 cellular users on request by Norwegian Radiation Protection Board, National Institute of «Working life» (Sweden), as well as SINTEF Unimed (Norway). The study showed that even people who use the phone less than 2 minutes a day, complained of discomfort and side-effects [17]. The problem of health grows, if the phones are used longer. Those who use the phone for about 30 minutes each day, increases the probability of losing of memory nearly 2 times, compared with those who confined to two minutes per day. Half of the surveyed users reported that when they use cell phones they experience the unpleasant heating of the head around the ear. Young people are subjected to the greatest risk. Those who are not yet 30, they are 3–4 times more often subjected to the side-effects. And in Japan, unlike to the UK in which a total of 30 million cellular users, the percentage of cellular phones in terms of population of the country is much higher. Perhaps it is this fact forced the Japanese government to revise the standards for levels of mobile phone radiation to the direction of tightening the requirements. Mobile phone manufacturers will be required to maintain the level of radiation does not exceed 2 watts per kilogram of brain client. The adoption of this decision reflects the concern of the possible impact of electromagnetic radiation on health, which is particularly increased after the publication of the report about the study of English scientists. However, the manufacturers do not consider that the government's new requirements greatly will affect on the development of mobile communications, as currently manufactured phones give radiation at levels from 0.13 to 0.6 watts [18, 19]. As we can see, the Japanese government does not want to harm with their actions to the most high-tech and the main profitable field of manufacture. Therefore, some legislators boggled taking restriction on deliberately inflated levels compared to the manufactured phone models. Since the phone is distributed electromagnetic radiation, and it is close to the human body, there is concern about the danger of radiation on health. This radiation is not ionizing, but it can cause a local increase of the temperature of living tissues and according to some scientists, lead to the appearance of chromosomal aberrations in cells (the presence of the effect is debatable) [20]. As the main possible effect of long-term exposure to RF fields is

considered cancer (brain tumor). It was investigated the effect on the activity and cognitive function of the brain, sleep, work of the heart and blood pressure; exposure in this area are small and have no obvious health values. Also, as the impact of mobile phone on health are considered risks of road accidents. While driving the use of mobile phones (including the speakerphone, in which the hands are free) increases the risk of traffic accidents 3–4 times. A dispute about the dangers or safety of mobile phones is constantly underway. Supporters of harm often express version of that financial interest of phone manufacturers is the reason of hide or «embellishing» the results of research on this topic. Under the principle of prevention**,** health organization recommends to minimize the time of using of mobile phone and its location close to the head, especially for children. Therefore, we consider that students must not use the mobile phones at school or they must abide by the following rules. When talking on the phone it is better to use headphones and loudspeaker, to keep away from the ear, it is not harmful. In order to mobile phone does not hurt your health, try not to talk a lot. The phone does not have to be in bed, in the workplace, it affects the nervous system and spoil the sleepy phase. Do not wear your phone on your belt, on the chest, in the pockets of your trousers and jackets. Electromagnetic waves are bad for the internal organs. If you talk on the phone for longer than 15 minutes, as stated in the second paragraph, it is very harmful to the ear [21].

Conclusions. Summarizing all the above, it should be noted that today we cannot be accurate to say that the use of cell phone is safe or harmful. Research in this area has been conducted, but the results are mixed.

We can draw general conclusions only comparing standards and phone each other:

The more wasting time talking on the phone, the more impact it has on people.

The greatest impact on the human body have an analog cellular standards such as NMT450i and AMPS [22].

This is due to high power as base stations and telephone transmitters themselves. Modern digital standards such as GSM 1800 and CDMA 800 has the least impact on the human body.

The more expensive the phone, the more likely that it has less impact on the human body. The high sensitivity of the receiver in the phone not only increases the transfer distance communication, but also allows you to use lower power transmitter at the base station.

It may be that to the health affects not only the emission of cellular phones, but the set of factors. For example, radiation and unhealthy lifestyle. I would like to add that the most secure today is the standard CDMA 800 MHz IS-95 [23].

This is mainly due to the fact that due to the peculiarities of the organization of the network, mobile terminals CDMA can maintain a quality connection to the database at minimum power — because power of all mobile terminals CDMA does not exceed 0.2 watts (compared to GSM & nbs; 900 where the tube emit «no more than» 2 W — the truth is it is the peak value of some older models of phones in unstapled connection).But the most «dangerous» from the point of view of the possible consequences of the impact of operation of the cellular terminal is a standard AMPS(which is almost not used in its pure form, although all the standard equipment DAMPS supports transition at poor communication with base to analog mode — in this case improves the range of the terminal in connection with the best path delay, but also increases the radiation power) [24].

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Ұялы байланыс құралдарды қолданудың адам ағзасына әсері

Мақалада адамдардың ұялы байланыс құралдарын қолдану барысында денсаулығына тигізетін әсері туралы мәліметтер берілген. Ұялы телефонның пайдасымен қоса адам денсаулығына зияны көрсетілген. Ұялы телефоннан шығатын электромагниттік сәулелердің адамның психикасына және физиологиялық жағдайына кері әсерін тигізіп жатқандығы белгілі. Адамдардың ұялы телефонды қолдану ережелерінің сақталуы туралы мәліметтер жан-жақты қарастырылған.

Н.Бейгам, Г.М.Тыкежанова, Д.С.Сташкевич

Влияние использования сотовой связи на организм человека

В статье представлены сведения о влиянии сотовой связи на здоровье человека. Показаны положительные и отрицательные стороны использования сотовой связи. Рассмотрены вопросы отрицательного влияния электромагнитных излучений, выделяемых сотовыми телефонами на психику и физиологическое сотояние организма человека. В статье даны основные правила использования сотовых телефонов.

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