BELARUSIAN STATE UNIVERSITY

Establishment of Education
«International Sakharov Environmental Institute»

ACTUAL ENVIRONMENTAL PROBLEMS

Proceedings of the VI International
Scientific Conference of young scientists,
graduates, master and PhD students

November 24–25, 2016
Minsk, Republic of Belarus

UDC 504.75
LBC 28.081
A43

A43 Actual Environmental Problems: the proceedings of the VIth International scientific conference for young scientists, PhD students, Master's degree students and students (in English), Minsk, November 24–25, 2016/ ISEI BSU; edited by S. A. Maskevitch, S. S. Poznjak. – Minsk: 2016. – 220 p.
ISBN

The conference proceedings include the theses submitted at the VIth International scientific conference for young scientists, PhD students, Master's degree students, and students "Actual Environmental Problems" in English, which was held in November 24–25, 2016 at the International Sakharov Environmental Institute of BSU.

The proceedings are referred to a wide range of experts, lecturers of higher and secondary educational establishments, PhD students, Master's degree students and students.

UDC 504.75
LBC 28.081

The conference proceedings are published with the financial and information support of the Ministry of Education of the Republic of Belarus

ISBN

SECTION 1

SOCIAL AND ENVIRONMENTAL, ETHICAL AND PEDAGOGICAL PROBLEMS IN ACCORDANCE WITH A. D. SAKHAROV'S IDEAS

Aliev M., Kuzina L., Surint T.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

PROBLEMS OF THE ORGANIZATION OF NON-WASTE PLANTS IN BELARUS

According to the World Health Organization (WHO), about 500 thousand chemical compounds are currently used in the world's activities. 40 thousand of such chemical compounds are harmful to the human organism, and 12 thousand of them are poisonous.

The use of traditional technology of raw materials processing that produce a variety of waste, which need subsequent exhaust gases, waste water and solid waste purification, is extremely inefficient, not only from the environmental point of view, but also from the economical one. Sewage treatment plants are very expensive, their work requires huge cost of energy and chemicals, which in some industries is up to 20–40% of the total investment, and the costs of disposal and recycling are up to 8–10%.

Consequently, there is a necessity for a brand new approach of the development of industrial production, namely, non-waste production. Natural "zero waste" production are some of the natural "ecosystem" – communities of living organisms in conjunction with the nonliving components of their environment, interacting as systems.

The idea of multiple, cyclical, economic use of material resources are actively put into practice in many countries. Thus, scientists from the Netherlands presented an improved recycling technology that separates and cleans all the waste into the original raw material without pre-sorting within a single system. The system completely recycles all types of waste (medical, household, technical) in a closed loop. Raw material is completely cleared of any impurities (pollutants, colourants, etc.), packaged and can later be reused. Moreover, the system is environmentally neutral.

Re-use of material resources is extremely important in the terms of maintaining or extending the usage time of major reserves of ore. In order to quantify their use indexes exhaustion of resources that characterize the spending of available world reserves of ores based on the annual pro-growth rates of their use. It is estimated,

for example, that even if metal stocks increase 10 times, the supply in raw materials will increase only by 2.5–3 times. Therefore, purposeful and systematic emphasizing of the role of secondary resources and the organization of technological substances cycle are needed for the rational development of the economy, which, in its turn, defines sustainable development of any country.

Environmental activities of JSC "Belaruskali" can serve an example of minimization of the production impact on water quality. Over the years, the company has been implementing a strategy aimed at water consumption reduction and the elimination of wastewater discharge into water bodies. Currently, all processing plants operate in a closed loop water supply without industrial wastewater discharge.

Astrouskaya L., Sivagrakau A.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ON PROMOTION OF 'ECOLOGICAL FOOTPRINT' IN THE REPUBLIC OF BELARUS

The Ecological Footprint was introduced at the beginning of the 90's by Mathis Wackernagel and William Rees. Originally, Wackernagel and Rees called the concept "appropriated carrying capacity". To make the idea more accessible, Rees came up with the term "ecological footprint" inspired by a computer technician who praised his new computer's "small footprint on the desk". In early 1996, Wackernagel and Rees published the book 'Our Ecological Footprint: Reducing Human Impact on the Earth'.

The Ecological Footprint represents the productive area required to provide the humanity with renewable resources and ways to absorb their wastes. The productive area currently occupied by human infrastructure is also included in this calculation, since built-up land is not available for resource regeneration. Ecological footprints can be calculated using any scale: for an activity, a person, a community, a city, a region, a nation or the humanity as a whole.

The Ecological Footprint is, in fact, one of the first comprehensive attempts to measure human carrying capacity, not as a speculative assessment of what the planet might be able to support, but as a description of how many planets would be necessary in any given year to support human demand in resources. Starting from its introduction into the academic debate, the concept has achieved increasing interest in society, from the scientific world to the common people. The results of the Ecological Footprint for 150 nations worldwide are well-known and rather striking: since the mid-1980's, the humanity's footprint has been larger than the planet's carrying capacity, and in 2008 humanity's total Footprint exceeded the Earth's biocapacity by approximately 44 per cent. In 2007, the Global Footprint Network estimated the global Ecological Footprint as 1.6 planet Earths: ecological services were used 1.6 times as quickly as they were renewed.

The sociological survey with the main topics “Environment” and “Ecological Footprint” of the residents of Minsk city and Minsk Region was conducted by the author in September – October of 2016. The survey based on the following parameters: housing, use of energy, transport, food, use of water and paper, recycling of municipal waste. The survey involved 51 people. Women (69% or 35 people) showed the greatest interest to the given topic. The age of the respondents ranged from 18 to 70 years.

The results of the survey showed that the average Ecological Footprint of respondents was 4.3 Hectares (2.5 planets), given the fact, that the average norm is about 1.8 Hectares. The excess of the norm was 2.4 times.

For comparison, the average U.S. resident uses 12.2 hectares (5.3 planets!), the average European resident uses 5.7 hectares (2.8 planets) and the average resident of Mozambique uses only 0.7 hectares (0.4 planet), the average resident of Russia uses 4.4 hectares (2.5 planets).

According to the results of our survey only 47% of Belarusian respondents know what the Ecological Footprint is. In total the population shows the high interest in the information about the state of the environment (69% of respondents selected the point that includes high concernment in the receiving information about the state of environment in the Republic of Belarus). Likewise, respondents specified about the inaccessibility of information about the state of environment in the region of residence.

The use of Ecological Footprint in our country in large scale (at national, regional and local levels, as well as at the level of organizations such as universities) could be additional instrument of promotion of environmental values, and principles of sustainable development and “green” economy in Belarus.

Batalevich N., Luchina V.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ON THE ISSUE OF THE RESTORATION OF AIR QUALITY IN THE REPUBLIC OF BELARUS

According to the latest data of the World Health Organization, published in October 2016, the mortality ratio caused by the effects of air pollution in our country (the ratio of the observed number of deaths among patients to number of deaths among people who are not suffering from the diseases) in the period from 2010 to 2012 was 100 per 100.000 population. With this index Belarus ranks the third place in the world. The first place in terms of relative mortality today belongs to Ukraine, the second to Bulgaria, and Russia ranks the fourth place. According to the data of the World Health Organization, about 3 million deaths a year worldwide are connected with the exposure to contaminated air.

94% percent of these deaths are caused by non – communicable diseases, such as stroke, lung cancer, cardiovascular diseases.

By the moment, the European Union have accepted some new non-standard measures for air pollution control, the main ones are: cleaning the air billboard and buildings which have been designed to clean the air. The billboard works with combining polluted air with water, using basic thermodynamic principles to actively dissolve the pollutants (such as bacteria, dust and germs) in water and to release fresh air. One billboard can do the work of 1.200 trees, purifying 100.000 cubic meters of air daily.

To clean the air from CO_2 and other harmful gases the air-cleaning buildings have been designed which are located in the big cities among skyscrapers surrounded by busy traffic roads, stations and factories. The structure soaks up CO_2 and other harmful gases and releases clear concentrated oxygen into the atmosphere. The structure of the buildings consists of a plurality of tubes that catches dirt, which then can be used in chemical industry.

At the moment the main purpose of the work units of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus for air protection stated in the Law of the Republic of Belarus of 16 December 2008, "On Air Protection", it is the adoption of conservation measures, restoration of air quality. The Republic of Belarus has lot of opportunities to set both air-cleaning billboards and buildings, and use reasonable European technology, which is called "Super Tree" which have been debuted by Peruvian company Tierra Nuestra. The device absorbs outside air, then under thermodynamic pressure combines the toxic elements in the air with water, and then pumps out clean air. The Super Tree cleans about 200.000 cubic meters of air per day eliminating polluting gases like carbon dioxide, as well as germs and bacteria.

On the basis of Article 4, "Basic Principles of Environmental Protection" of the Law of the Republic of Belarus "On Environmental Protection" of 26 November 1992, in order to ensure improvement of air quality by reducing emissions of pollutants from mobile sources, it is necessary to prohibit the import cars below the Euro 5 into the territory of Belarus and enter the sign "non-ecological transport" which prohibiting the movement of old vehicles. At the same time regional authorities may decide where such signs should appear. We need to enter a fine for violation for car owners and ways to offer the owner to upgrade to the desired class, or dispose of and compensate the price of the car to the owner.

Blagodarova Y., Lepskaya N., Subbota E.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ENVIRONMENTAL ADVERTISING AS ECOLOGICAL WORLD VIEW FORMATION METHOD

Nature protection is one of the most crucial problems today. During all the period of humankind existence there was a contradiction between human needs and environment capabilities. A human is an essential part of the nature; he lives and develops by the laws of the nature. At the same time, a human is a sensible social creature, but his injudicious and selfish actions are often a reason of ecological crisis.

Currently, due to the abundant troubles in natural ecosystems caused by human influence, the problem of ecological world view formation among the youth is really immediate. Ecological world view is a system of knowledge about environment, which consists of two components: natural and man-made ones. Human health and his lifespan depends on the condition of the ecosystem. Surely, any environmental changes based on natural resources consumption and pollution affect people.

Environmental advertising plays a special part in ecological world view formation. At first, the concept of environmental advertising was mentioned in 1906. 'American civil association' organized a company in support of Niagara Falls due to the harm of generating company.

The goal of environmental advertising is to change public attitude to any ecological problem and to make new values. It affects people on emotional level mostly and appears during advertisement processing – emotions, thoughts, different decisions detect people's behavior.

In order to show environmental damage, severe and shocking materials are sometimes used in advertising. It is potentially possible to form a proper ecological world view using a principal of naturalism.

Advertisement is a powerful tool to form public opinion as it contributes to nature protection, reconstruction of humanistic relationships between human and nature, development of new economic contacts and building of civil society. Environmental advertising has a great potential for development.

Bogdanyuk E., Dumcheva A.,
Kononchuk N., Olevskaya I., Sybbota E.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE IMPACT OF INFORMATION TECHNOLOGIES ON CONTEMPORARY SOCIETY

We can quite literally say that nowadays information technologies take hardly a small part of our life.

People in contemporary society can hardly imagine their lives without machines. Every day new devices occur or the current ones are improved. People have different attitudes to new devices. Some people believe that high-end gadgets are actually useful and necessary, while others are absolutely awful due to the negative influence on people.

However, what is social advancement in deed? It is development, transformation from the lowest to the highest, from the least perfect to the most perfect. It is a constant ability to improve human intelligence, science advancement and, of course, development of moral qualities. When we realize what the progress is, we will come to the conclusion that it is extremely contradictory, especially in contemporary society. On the one hand, we have progress, but on the other hand, we face degradation or regress.

Firstly, gadgets do all kinds of dirty and hard work as cleaning. Secondly, devices can save a lot of time as well as storage space. For example, a computer disk can contain the same amount of information as several thick books. Therefore, machines help people in different fields. People are reluctant to work due to the influence of machines. People become lazy and disorganized. They just expect their latest gadgets to do everything instead of them.

On the one hand, technologies are a huge step ahead for humankind. On the other hand, people are becoming more affected by technologies. They ignore their household duties, studies or work and spend more and more time with a lap-top or TV.

A tragedy for many people is to forget a phone at home. For most who are just killing time in social networks, live communication is replaced by a set of letters on the computer, the gestures and mime with smileys. However, we abuse these benefits. We are easy to write a short message to man, who lives next door, than to meet him. People stopped coming to visit and just see each other.

Our life became easier, we have more free time, but we just waste this time. Of course, some people use the Internet for personal-development, but still most humans are on the downward path.

In modern society, the popularity in the online network is much more important than in real life. An individual is estimated by his status in the social network. If he

has few pictures and friends in the Internet – many people will not have the desire to communicate with him.

People are trying to create a picture of a beautiful life, which is often an illusion.

Adjusting to the fashion of modern society, a person loses his self-identity. The man is afraid to live a real life.

Boika M., Merkulova I., Mamaiko A.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

RESPECT TO ANY LIFE FORM AS THE WAY TO MORE HUMANE ALTERNATIVE

> "The system which is supposed to teach biologists should also allow to teach future teachers and researchers to respect any life form, have insight of an animal and sympathy for it"
>
> *T.N. Pavlova*

At the modern stage of social development, the ideas of global bioethics affecting the humanization of education, especially biomedical, are directly connected with the spread of the ideas of global bioethics in modern society. For biologists, physicians, environmentalists, the treatment of animals in general, and in particular experimental is not only a personal ethical choice but also the component of professional ethics.

The process of humane education is actively developing in universities in many countries where a legal base and the industry production of affordable educational alternatives to experiments on animals are used in the educational process, excluding their death, infliction of suffering as a result of educational experiments. These alternatives include the model and training mannequins of animals, computer training programs, virtual laboratories, videos, as well as cell culture, tissue and corpses of animals derived from ethical sources. Well-developed alternatives, especially in various combinations, can be much more efficient ways of the use of animals.

In Belarus, the system of bioethical education of students has been developed and implemented (T.V.Mishatkina). International Sakharov Environmental Institute of Belarusian State University was one of the first universities in the former Soviet Union, where the course of bioethics was included in the curriculum of applied bioethics. Debatable questions are considered in many chairs, and experiments involving animals in laboratory animals are replaced with alternatives.

The purpose of the conducted research is to find out the attitude of students of the Faculty of Environmental Medicine of International Sakharov Environmental Institute of Belarusian State University to the ethical issues of using animals in the

learning process. For this a questionnaire was developed, including the use of animals during the practical training or scientific experiments, reflecting opposing views and neutral attitude to this problem.

The survey covered 100 students from the third and fourth year. Thus, 61% of all surveyed students supported the idea of banning experiments on animals. In order to humane treatment of experimental animals. 11% of the students were not able to express their position on this issue. It should be noted that most of the 3rd year students (58%) and 4th year students (57%) believe that it is necessary to find and apply the humane methods of replacing animal experimentation.

From a scientific point of view, the use of modern information technologies, non-invasive methods of research and the various alternative approaches, avoids the death of laboratory animals, which in turn saves time and money, and improves the accuracy and the reliability of the of data. From the ethical point of view, compliance with the humane treatment of animals indicates the culture of research - ethical and professional, reflecting this trait of personality as the capacity for compassion.

The study of bioethics and the active use of alternative methods in the educational process of students at the International Sakharov Environmental Institute of Belarusian State University, allows you to make a conclusion that the knowledge is more efficient and skills of students as future professionals are more developed in both quantitative and qualitative aspects.

Brinkevich A., Bonohova Y., Olevskaya I.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

SOME PROBLEMS OF ECOLOGICAL EDUCATION

Ecological culture is the sphere of human life, where we need to find answers to environmental problems, because it is based on universal values. The main indicator of ecological culture of a person is social and individual environmental responsibility for the events in nature and people's lives. The formation of ecological culture of a person begins in childhood and continues throughout a person's life. It is therefore necessary to cultivate human ecological culture during life.

The basics of environmental education starts in pre-school. Currently, preschool environmental education in the Republic of Belarus takes stage in its becoming. Children receive primary ecological knowledge about animals and plants, climate and seasonal changes in nature, learn to take care of the wildlife, and energy resources, efficient use of natural resources. However, nowadays this knowledge is not enough to develop skills of observation and care about objects animate and inanimate nature, the implementation of the general strategy of environmental education.

Secondary Education provides a number of academic disciplines for the formation of skills and abilities, but, unfortunately, there is no a special discipline to

study the ecology and management of natural resources in high school. Environmental education takes place here because of academic disciplines which consider issues related to the environment, but the number of hours devoted to environmental issues is small.

A special role in the system of ecological education belongs to higher educational institutions. Exactly at this level of education preparation of specialists of environmental profile starts in the Republic of Belarus. According to the data for 2014 on the profile of "Environmental Science" just over 1% of the total number of students studying in 45 public institutions of higher education were trained. Neither one of 922 private universities and institutions prepare specialists in environmental fields. On a number disciplines of natural-science , pedagogical, technical profile subjects related to environmental protection are taught. Thus, about 3.6% of the total number of students receive a good preparation in the environmental field.

In some institutes it is possible to study at Master's degree in environmental profile: "Ecology", "Geoecology", "Radiobiology". The number of graduate students in these specialties is 1.5% of the total. Unfortunately, there is no demand for depth training specialists in environmental sciences and new specialties with a practical orientation are not opened in our country.

It is obvious that the system of ecological education of the Republic of Belarus has gaps in all its stages. There are many ways to solve this problem, but, in my opinion, to raise the level of responsibility of teachers in the field of ecological culture, the formation of high ecological culture of students, increasing training hours through the introduction of additional subjects, courses or electives environmental profile in schools, vocational and secondary special educational institutions will be the most effective. Also it is worth to pay more attention to environmental education in pre-school educational institutions. It is possible to use the experience of foreign systems of environmental education. For example, in Western Europe special facilities in which children can communicate with animals, care for them are important in the process of environmental education. It is necessary to pay special attention to the training of teachers of pre-school institutions, as is done in Norway, where the workers of kindergartens are required to have special training. They must know the basics of ecology and environmental protection, the condition of the natural resources of their country, to be able to perform techniques of environmental education.

Bushkevich N., Sivagrakau A.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE HAPPY PLANET INDEX IN BELARUS

The Happy Planet Index is an index reflecting the welfare of the people and the environment in different countries, which was suggested by the New Economics Foundation (NEF) in July 2006. The main task of the index is to reflect the "real" wealth of nations. To compare living standards in different countries use GDP per capita or HDI, but these indices may not always reflect the real situation. In particular, the comparison of the value of GDP is considered irrelevant, since the ultimate goal of most people is not to be rich but to be happy and healthy.

HPI is based on general utilitarian principles that most people want to live a long and full life, as countries strive to do everything possible to achieve maximum well-being of its citizens, wisely using the available resources, without causing damage to the environment. For the calculation of the index three indicators are used: subjective satisfaction of people life, life expectancy and so-called "ecological footprint".

For the first time the HPI was designed in 2006, it included 178 countries. The second time the calculation was carried out in 2009, it included 143 countries. In 2009, the most "happy" countries were: Costa Rica, the Dominican Republic and Jamaica. The most "unfortunate": Zimbabwe, Tanzania and Botswana.

The purpose of our study was based on survey to know what percentage of the population of Belarus know about HPI, as well as how they relate to him.

The survey involved 45 respondents, 24 of them are under the age of 20 years, 10 people aged 20 to 30 and 11 people aged 50 years and older. The survey involved students, workers and people working in the service sector.

The survey showed that 100% of respondents have never heard of The Happy Planet Index but showed interest in this issue.

After some investigation we found that on the HPI is not mentioned in the newspapers or radio and TV programs. In this regard, people may not know about this rating.

Summing up, we can say that Belarusians are concerned about their quality of life and place of Belarus in the international rankings. To increase the interest of citizens should be broadcast on television and write in newspapers about the places occupied by the Republic in international rankings, as well as on measures to improve the quality of life in the country.

Also it could be prospective to use HPI at the regional and local levels in Belarus that could help to find better solutions for sustainable development of these territories and local communities.

Gaikova E., Kuzina L., Surint T.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ECOLOGICAL AND ECONOMIC PROBLEMS OF THE WORLD OCEAN

A special feature of the World ocean as the most important object of environmental protection is that the currents in the seas and oceans rapidly transport pollutants for long distances from their dumping sites, consequently its eco-economic problems have international character.

The dependence of almost any modern production on water, which also plays an important role in the goods transportation, caused the concentration of household objects and populations close to water sources. As a result, up to 90% of harmful substances enter the water body from wastewater dumped by economic sites and welfares. Coastal waters are annually refilled by 320 mil.tons of iron, 6.5 mil.tons of phosphorus, 2.3 mil. tons of lead and by many other pollutants, including highly toxic ones.

The most polluted waters are waters of the Persian Gulf and the Gulf of Aden, the Indian Ocean, the equatorial part of the Pacific Ocean, waters of the Gulf Stream in the Atlantic, the North Sea and the Mediterranean.

The main sources of hydrosphere pollution are, first of all, the food industry and agricultural enterprises. The most widespread pollutants contaminating water body are oil and oil products. On average 13–14 mil.tons of oil products get into the World ocean annually. A thin hydrophobic film that prevents free gas exchange with the atmosphere appear in the process of oil pollution. Oil spills caused by supertankers crashes lead to large scale environmental disasters.

Up to one bil. tons of oil products are annually transported by seaand not less than 1 million tons of them fall into the World ocean. However, minor but systematic oil and oil products dumping by onshore and floating objects causes the greatest harm. They estimate up to 97% of all oil pollution of the World ocean. Environmental problems have been lately equaled to the problems of human survival. Recently industrialized countries, as well as most industrially advanced countries have already contaminated or continue contaminating their rivers, lakes and coastal waters by various chemical and biological wastes of industrial and domestic origin. Untreated wastewater discharge from industrial and residential areas into rivers and seas is common, but unreasonable. Investments related to measures that prevent such discharge may be fully justified due to the possible severe consequences for human health, moreover, general water pollution, while reducing the number of sources that can be used for the needs of the population, is able to deprive society of opportunity to satisfy the demand for water effectively.

Nowadays it is impossible to estimate complete Water ocean pollution damage, but the consequences, caused by careless attitude of humankind to the global ocean

is visible today and it is terrifying. Successful restoration of water resources can be realized only with the help of the whole set of measures.

Galitskaya E., Kuzina L., Tretyak G.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE PROBLEM OF OVERPRODUCTION OF FOOD RESOURCES AND METHODS OF ITS SOLUTION

One of the global and intractable humanity issues today is hunger. 24 thousand people die and about 1 billion people starve every day in the world.

There are a lot of causes of poverty and starvation. One of them, it sounds ironically but is not a deficit, but overproduction of food.

According to the data of the UN, the world produces enough food to provide every person with 3500 calories a day, but the use of food resources is not rational in the world. Firstly, they are unevenly distributed, and secondly, there is an overproduction of products in many regions. People in the United States and Western Europe are not physically able to buy and eat the amount of food, which comes on the shelves. As a result, manufacturers, and especially suppliers are forced to dispose of unclaimed goods.

Food waste - the world's third largest source of greenhouse gas emissions that affect climate change and harm the environment.

Also, one third of all manufacturing products is wasted. Thus, 40 per cent of food products are wasted in the USA, 100 million tons of products are wasted per year, with most of them fresh and edible. According to the statistics of the researchers from Harvard University, Americans throw products for a total amount of $ 165 billion annually. At the same time most of the countries of the "third world" are still experiencing food shortages. About 805 million people suffer from malnutrition, and that is every ninth inhabitant of the planet.

The report entitled "Problems of the global food industry" also contains data that the production of food products that do not even reach the consumer needs huge amounts of water – up to 550 billion cubic meters per year.

The problem could be solved if people spared food, but population of developed countries has no motivation to save food, as the cost of food takes less than 20 per cent of the family budget. In developing countries this percentage exceeds 60 per cent, but in the USA is less than 10%. In developing countries, the situation is different: the food often takes the first place.

In our opinion the technical solution to the problem of overproduction and spoilage of food would be the spread of biomass processing plants. Such plants are a type of alternative energy. While recycling food waste experts receive methane and fertile silt which are then used for the production of heat energy and electricity.

However, this problem can not be solved globally. Only people's decision will determine whether 40 per cent of food on the planet continues to be produced in vain.

Gurlo D., Streluyk V.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ASSESSMENT OF THE THREAT OF NUCLEAR TERRORISM

As the distribution on Earth of nuclear technologies and increasing the threat of their use is becoming increasingly important to protect the global community from impending nuclear disaster.

Leading world powers and international organizations are seriously engaged in the development of a set of active and preventive measures for the reduction of nuclear arsenals, non-proliferation of nuclear weapons and nuclear technology and prevent nuclear terrorism.

Nuclear terrorism is the intentions and actions of individuals or groups in possession of nuclear weapons or radioactive materials for subsequent use or threat of use, as well as attack the nuclear infrastructure in order to cause casualties, environmental damage, to achieve certain political or economic goals.

There are following targets of NT: terrorist bombs, smuggling, NPP and facilities.

First, terrorist bombs:

Designs for reliable nuclear weapons are openly available and building them repeatedly proven to be well within the capacity of competent undergraduate physics students. You can find information about design nuclear bomb in Google.

The most difficult part of constructing a nuclear weapon is obtaining the fissile material required – either highly enriched uranium (HEU, enriched to 20% or more) or plutonium (Pu). Plutonium is more radioactive, but terrorists could handle it with simple equipment such as rubber gloves and polyethylene sheeting.

Second, nuclear smuggling

There are a lot of examples of smuggling in nuclear history.

- Dec 1993, Odessa, 40 kg of uranium seized
- Dec 1994, Czech police seized 4 kg HEU, the same year German more than 400 g Pu.
- Oct 2001 Turkey 1.16 kg weapons-grade uranium in;
- Russia, stealing 22.2 kg LEU in April 2006

This is a real danger: the global stockpile of HEU and Pu currently amounts to 2300 tons, enough for more than 200,000 units of nuclear weapons. These materials exist in hundreds of buildings in more than 40 countries.

Finally, NPP and facilities

Currently 441 nuclear power plants operate in 31 countries. The most likely terrorist targets are the reactor itself and the ponds storing the spent fuel.

There is a high probability that a nuclear terrorist attack will occur during the next decades. A dirty bomb attack is probably essentially inevitable.

Ending risks of nuclear proliferation and terrorism will require comprehensively securing radioactive sources, an end to uranium enrichment and reprocessing of spent reactor fuel, abolition of nuclear weapons, and phasing out of nuclear power generation.

Kacharhina N., Lepskaya N.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

SOCIAL ASPECTS OF BIOTECHNOLOGY

Biotechnology cause the formation of a new type of relations between society and nature, where the central idea will be the idea of "reverence for life", the unity of man and nature. Biotechnologies are social by nature, they are realized in a society and determine social needs, interests. The development of biotechnology is influenced by various social factors such as social needs, the system of social relations. Therefore, biotechnology has pronounced humanistic aspect related to the definition of the boundaries of biotechnologies. A crucial constraint on the development of biotechnology, and perhaps other technologies too, is the global revitalization and reinforcement of the religious dimension that has taken place in the past decades. Many people believe that they see in this development not only a quantitative increase, but also a fundamental change in the religious dimension and its relationship to other cultural and social dimensions. The development of biotechnology, especially human biotechnology, is one of the key arenas where these change processes are expressed as more or less powerful reactions against what is perceived as the objectification of life, body and mind. The social nature of biotechnology allows us to understand its axiological content that appears in the value of the realization of biotechnology as a special form of social activity. Transforming social realities with the help of biotechnology, the invasion in the evolution of life may create a threat to human existence. The main concerns of biotechnology became more and more relevant, related to issues of bioethics and biosafety, such as bioterrorism (e. g., genetically modified bacteria resistant to treatment or preparations erasing memory); social control (e. g., drugs to pacify the aggressive individuals or forced birth control); enhancement of our bodies and minds (drugs that improve memory), and if that enhancements become widespread the issue of equal access may arise. As a result there will be a split in society, which may lead to devastating results as it is a potential threat to the security, freedom and even human nature itself.

As the products, methods and terminology of biotechnology make inroads into new markets and areas of society and experience, the basis is expanded for empirical studies of dilemmas, options and impacts related to the development of biotechnology. One feature of the development of biotechnology is that it often takes

longer, has different impacts, follows other paths and is more complicated and multifaceted than anticipated. This necessitates continued vigilance, knowledge development and a wide-ranging debate on the further development of biotechnology. If the international scientific community is be able to take a responsible approach to the development and application of bioethical norms and principles there will be the development of biotechnology in medicine, biotechnological aspects in the processes of transnational interaction and social controlwill be managed to integrate in future. On the base of the safe use of such technologies it has all chances to make possible the most significant leap in the history of the human population. Furthermore, the process may serve as a guide for dealing with other, related technologies.

Kapustina T., Zhuk E.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE IMPLEMENTATION OF ADDITIONAL EDUCATION AS A PART OF THE COURSES DISTANCE LEARNING

One of the priorities of social-economic development of the Republic of Belarus is accession to one of the leading countries in terms of development of information and communication technologies and their usage in society.

Nowadays due to an informatization of society there is an active implementation of information products, tools and technologies in all spheres of human activity, primarily in the education system. Using modern information technology provides the organization of educational process, training manuals, monitoring of students' knowledge, searching the information on the Internet, as well as providing the possibility of learning at a distance, i.e. distance learning, which main objective is the ability to freely receive the necessary educational services of high quality that meet the educational needs in any place and at any time.

It may have to be dealt with distance learning using a large range of different tools, services, and technologies. The most popular distance learning system is a freely available system Moodle (Modular Object Oriented Dynamic Learning Environment) that is used in more than 200 countries around the world. Moodle is an open platform for the organization of e-learning over the Internet, which is set up under the auspices of UNESCO and allows not only to provide training materials in electronic form, but also to exercise control over the use of these materials of each student, to accumulate information about the learning process. Through the mechanisms of control, you can measure the effectiveness of e-learning and professional development of the judge as a result of training. And given that students and teachers remotely separated from each other, modern distance learning course includes a variety of communication tools to individually contact with the teacher and other students (email, chat), and to put certain issues to the whole group.

The possibilities of modern distance learning technologies can successfully apply them to teach virtually all categories of students, however, the most widely used distance learning is gained in the field of training. Advanced training in remote form can help to improve theoretical and practical skills on the job of a specialist at a convenient time.

Within the framework of the international Tempus project 543707-TEMPUS-1-2013-1-DE-TEMPUS-JPHES "Ecological Education for Belarus, Russia and Ukraine" distance courses for target groups: teachers of secondary schools and college teachers have been developed.

Using this form of training with innovative approaches to education can improve the efficiency of the formation of ecological literacy of teachers and students, provide the flexibility of the learning process and provide interactive communication between all participants of the educational process.

Kavaliova V., Kuzina L.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE PROBLEMS OF TRANSITION TO GREEN ECONOMY

Analysis of the adoption of the National Strategy for Sustainable Development for the period to 2030 year, allows to make a conclusion that in the future the Republic will develop in “green” scenario. Successful development will allow our country to be among the first 40–45 countries with high human development level.

"Green" is an economy in which the welfare of the people increases, social justice ensures while significantly reducing environmental risks. With such a model of economic development most funds are invested in sectors related to the increase of the natural wealth of the land and reduce ecological scarcities. These include renewable energy, low-carbon transport, energy efficient construction, "clean technology", the provision of drinking water, wastewater and air treatment, waste management, sustainable agriculture, forestry and fisheries, etc.

In our opinion, firstly it is necessary to ensure the priority of “green” investments through the achievement of the balance of interests of state and business. “Green” investments must ensure the development of the environmental industry and other sectors of the economy.

The new sectors and technologies that are attractive to investors include: energy production from renewable sources, resource and energoecological buildings and equipment, the public transport system with low fuel consumption and cars using clean energy, power for recycling and waste management, investment in human capital(education) for the acquisition of knowledge and skills required for a green economy, the production of environmentally friendly products.

The interests of the state in the development of the green economy are determined by radically changing employment, reduced poverty and dependence on imports.

Thanks to the support of international donors in our country a multi-component project funded by the European Union has been launched since January 2015. Its task is to put the "greening" of the national economy. The project budget of 5 million euros has many partners: the Ministry of housing, Ministry of energy under the guidance of the Ministry, covers 4 regions: Minsk, Brest, Grodno and Gomel, and is going to run until 31 December 2017. Other projects are implemented successfully.

At the same time, in our country there are a number of issues, without which progress towards a green economy will be held back as the lack of growth of the environmental industry. We have a huge aging capacity in cleaning environment that requires upgrading and is not covered by the greening of areas such as recycling and sorting of waste, recycling and disposal of industrial products after use, etc.

Ostapchenya D., Burak V., Olevskaya I.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

PSYCHOLOGY OF HUMAN BEHAVIOR IN INTENSE, EXTREME AND EMERGENCY SITUATIONS

Despite the various ways of behavior of a human's organism in an emergency, people are often influenced by the condition of others. Sometimes inadequate behavior of a group of people can lead to unpredictable consequences. Group behavior is often connected with one and the same external event and depends on the emotional factors which are formed by group mentality, but not with the individual characteristics of the human psyche.

Emergencies can not be divided by severity. Every particular situation has individual psychological consequences for its participants and witnesses. The degree of psychological damage depends on a human's personality, his or her internal resources, coping mechanisms.

By nature of exposure it is possible to distinguish physiological and psychological or mental types of stress. Regardless of the variety of stressors, the effects are studied on physiological, psychological, and behavioral levels and they are mostly negative. Commonly, emotional changes occur, motivational sphere is deformed, the course of the processes of perception and thinking changes, causing motor and verbal disorders. Particularly strong disruptive effect on humans is produced by emotional stress, which have reached in some way the degree of affect (impulsive, braking, generalizing). The strength of the affect has an ability to inhibit any psychic process. Thus, the optimization of mental states and human behavior in extreme situations requires appropriate psychological preparation,

otherwise an individual in emergency won't be able to act rationally, energetically, in a persistent way.

The features of emergency situations are: unexpected character of danger, unawareness of the possible consequences of a natural disaster or accident and of the rules of behavior in this situation, the lack of experience and skills in dealing with he emergency, weak moral and psychological preparation. All these factors create danger for human life and health, affect the functioning of his psyche. The factors that boost mental stress, in some cases, may have a positive effect on the person, or a negative impact, causing panic and stress.

An essential role in any kind of activity and behavior is played by adequate state, which is the most important part of the whole mental regulation. Many aspects of mental states are not yet profoundly studied, so the theory of mental states is far from being complete. The Human, who often has to be in an emergency, is able to develop the skills of most appropriate mobilization of his functions, as well as adequate responses to it. So it is possible to obtain different technics of fear elimination. As a result the sense of satisfaction with your performance and successful experiences increase self-credibility and contribute to a better adaptation to extreme situations that may arise as a result of emergency.

Platun E., Kapustina T., Zhuk E.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE EXPERIENCE OF THE IMPLEMENTATION OF ADDITIONAL EDUCATION WITHIN A SOLUTION OF ENVIRONMENTAL SAFETY ISSUES

The modern society pays a special attention to the problem of environmental protection. One of the most important reasons of the growth of environmental problems is the lack of population competence. The environmental safety is an integral component of ecological ideology of the human. The concept of environmental safety is an interdisciplinary subject and integrates environmental knowledge and skills of specialists in different fields.

The program "The professional competences in the field of environmental security", which is intended to improve qualification in environmental education for college teachers, was implemented within the international project "Tempus 543707-TEMPUS-1-2013-1-DE-TEMPUS-JPHES "Ecological Education for Belarus, Russia and Ukraine".

The automation of the studying process is one of the structural and informative features of the courses, along with the increasing role of self-assisted work of students and individualization of studying. That's why modern distance education course system is a good way to organize and support the studying process. This

course has been placed on the Moodle platform, which is now widely and effectively used for distance learning education.

The main goal of the course is to teach a specialist by modern ideas about the environmental situation in the present, new approaches to the process of the formation of environmental awareness and responsibility in the relationship with the environment.

The aim of the course is to provide a systematization of conceptions of specialists that belong to different professions about the importance of combining all the knowledge acquired during the study of biological and ecological disciplines in a certain sequence. The course includes two sections: "Environmental Safety in the concept of sustainable development" and "Radiation Safety", which has lecture material with theoretical knowledge. The students have to pass a practical task after studying the theoretical part. After completion of the course the final control of knowledge in the form of a test has to be passed. As an additional material there is a glossary with basic terms that are used in the training course and a list of references.

The formation of environmental competencies in the field of environmental safety within innovative approaches in education increases the efficiency of the educational process.

Putchynskaya B., Sivagrakau A.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE 6-HOUR WORKING DAY IN SWEDEN: WHAT ABOUT ISEI BSU?

Some companies in Sweden are moving to a six-hour working day in a bid to increase productivity and make people happier. Employers across the country have already made the change. The aim was to get more done in a shorter amount of time and ensure people had the energy to enjoy their private lives. Filimundus, an app developer based in the capital Stockholm, introduced the six-hour day last year. To stay focused on a specific work task for eight hours is a huge challenge. In order to cope, they mix in things and pauses to make the work day more endurable. At the same time, it's hard to manage the private life outside of work. Staff members are not allowed on social media, meetings are kept to a minimum, and that other distractions during the day are eliminated - but the aim is that staff will be more motivated to work more intensely while in the office. The new working day would ensure people have enough energy to pursue their private lives when they leave work – something which can be difficult with eight-hour days.

A Swedish retirement home may seem an unlikely setting for an experiment about the future of work, but a small group of elderly-care nurses in Sweden have made radical changes to their daily lives in an effort to improve quality and effi-

ciency. In February the nurses switched from an eight-hour to a six-hour working day for the same salary – the first controlled trial of shorter hours since a rightward political shift in Sweden a decade ago snuffed out earlier efforts to explore alternatives to the traditional working week. The Svartedalens experiment is inspiring others around Sweden: at Gothenburg's Sahlgrenska University hospital, orthopaedic surgery has moved to a six-hour day, as have doctors and nurses in two hospital departments in Umeå to the north. And the trend is not confined to the public sector: small businesses claim that a shorter day can increase productivity while reducing staff turnover. At Svartedalens, the trial is viewed as a success, even if, with extra 14 members of staff hired to cope with the shorter hours and new shift patterns, it is costing the council money. Ann-Charlotte Dahlbom Larsson, head of elderly care at the home, says staff wellbeing is better and the standard of care is even higher.

At Toyota service centres in Gothenburg, working hours have been shorter for more than a decade. Employees moved to a six-hour day 13 years ago and have never looked back. Customers were unhappy with long waiting times, while staff was stressed and making mistakes, according to Martin Banck, the managing director, whose idea was to cut the time worked by his mechanics. From 7 a.m. to 4 p.m. working day the service centre switched to two six-hour shifts with full payment, one starting at 6 a.m. and the other at noon, with fewer and shorter breaks. There are 36 mechanics on the scheme. "Staff feels better, there is low turnover and it is easier to recruit new people", Banck says. "They have a shorter travel time to work, there is more efficient use of the machines and lower capital costs – everyone is happy". Profits have risen by 25%, he adds.

The effects of introduction of 6-hour work day include the following: 1. it allows workers to focus more intensely; 2. six-hour workdays increase productivity; 3. it improves quality of life for employees. We can add the environmental effect to these, too.

Our university has 2 shifts of teaching. Based on the Swedish position, the students have to learn, from 8 to 14 or from 14 to 20. Now students are often not satisfied with their schedule and with the fact that they have to be at the University for almost a day (sometimes up to nine hours). At the same time there is almost no free time, because at home they have to prepare for classes for the next day. But are they ready to engage intensively for six hours without interruption in order to have more free time? Will this at the same time increase their efficiency? We offer to conduct such an experiment to understand how to improve the conditions and the effectiveness of learning and teaching.

Rebeeva M., Olevskaya I., Tsurdeeva A.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE IMPACT OF THE ENDOCRINE SYSTEM ON THE MENTAL AND PSYCHOLOGICAL HEALTH OF THE PERSON

The endocrine system is responsible for the control of all main functions in the body, so even the slightest hormonal disorders require special attention.

Questions regarding the human endocrine system diseases concern a large number of patients, as hormonal disorders leading to violation of the normal functionality of many organs and systems of the human body.

Mental health is an important part of human health. This is primarily due to the fact that the human body where all elements are interconnected with each other and interact with each other is largely controlled by the nervous system, so the mental condition affects the operation of each of functional systems, and state of the latter and affects the psyche.

Psychological health is a dynamic set of mental properties of the person providing the harmony between the needs of the individual and society which are the prerequisite personality orientation perform its vital task.

Life tasks at the same time can be seen as something that needs to be done to others it is a specific person with his abilities and capabilities. Carrying out the vital task the person feels happy, otherwise are deeply unhappy.

Psychological culture of personality is a characteristic of the harmony of the main processes of building and behavior management. It is expressed in a good enough self-control actions and emotions in a constructive dialogue and constructive management of different cases. There are significant processes of self-determination, creativity and self-development.

Ryzhkova V.[1], Melnov S.[2]

[1] *International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;*

[2]*Belarusian Research Center «Ecology», Minsk, Republic of Belarus*

THE MAIN ETHICAL AND SOCIAL ISSUES IN SEARCH OF BIOMARKERS FOR AUTISM

Autism is a highly heterogeneous disorder, with a strong genetic basis and many associated medical and behavioral comorbidities. Current diagnostic methods and screening tools are subjective and difficult to assess in younger children, which often results in missed opportunities for early intervention, and makes targeted therapy difficult. A biological marker that could solve these problems would therefore have great clinical utility. Research in this field has greatly increased in recent

years, however, growing enthusiasm about recent advances needs to be tempered by an awareness of the major scientific challenges, and the important social and ethical concerns arising from the clinical application of biomarkers. Despite huge advances in the basic understanding of autism, comparatively little has been achieved with regard to translating those findings into clinically useful biomarkers. We have considered some of the key challenges that the field has yet to overcome.

The difficulties in the search for autism biomarkers reflect the biological heterogeneity of the condition and the ethical debates about the therapeutic interventions arising from biomarkers, centre around this heterogeneity.

The prospect of autism biomarkers highlights the fundamental question of what value to place on autism as a condition. Autism is generally described in a negative way by listing its core attributes as impairments in social communication; narrow, but deep interests; and stereotyped behavior, but some argue emphasis should be placed on the more positive aspects of the condition. This has given rise to the debate over whether or not autism is a truly disability.

The issue that probably causes the most concern to the general public, including the autism community and those with particular religious, cultural and personal views, is the twin prospects of prenatal diagnostics leading to large-scale elective abortion of fetuses deemed to be at risk and, an avoidance of having children by those identified as at risk of conceiving autistic offspring.

Another challenge is to translate biomarker information into clinical practice. If there is a natural reluctance on the part of many people to bring children with disabilities into the world, then it is imperative that biomarker-based information on risk of autism is translated into clinical practice with great caution and care. Thresholds for clinical utility of biomarker information (i.e acceptable levels of sensitivity and specificity of biomarkers in the clinical setting) have thus far been decided by scientists.

In our view, the issues that we have addressed should lead to continuing discussions that are conducted openly and that are not restricted by one-dimensional scientific research agendas or through governmental regulations. Only through this difficult process of discussion, debate and discovery we can gain clarity on which areas of autism should be accepted in principle, and which should be prevented or cured, if this becomes possible.

Scryabina D., Luchina V.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

LEGAL REGULATION OF PLANT BIODIVERSITY CONSERVATION IN THE REPUBLIC OF BELARUS

Preservation, enriching and efficient use of plant biodiversity is one of the ways to solve today's global problem i.e. interactions between nature and humans. Since

the Republic of Belarus has signed the Convention about Biological Diversity (Rio de Janeiro, 1992), researches are aimed at the rational use and genepool enrichment of plant resources as the priority.

The main principles of state regulation in the field of treatment of flora objects is a priority in conservation, protection and reproduction of plant objects. Regulation of the number and the conservation of plant biodiversity is done by the Law of the Republic of Belarus "About Flora" signed on June 14, 2003. If we talk about rare and endangered plants in our country, the Red Book of the Republic of Belarus is the main document which integrates the number of species of wild flora. Nowadays, there are 4 editions of the Red Book: there are 85 species of flora in the first edition of 1981, there are and 303 species in the latest edition.

It is well known how important the problem of unlawful taking of wild plants from their native habitat is. The article 15.27 of the Code of the Republic of Belarus "On Administrative violations " from 21 April 2003 ragulates the responsibility for the offenses, but in the first place, if there are wild plants or Red Book plants in any biotop, it is necessary to mark the area visually by signs showing which species can grow here.

Also invasive plants are a problem for wild plants. A quantity of invasive flora increases mainly because of the traffic's expansion between habitats that are different in composition. Article 26 of the Law of the Republic of Belarus "About Flora" in some way prevents the spreading of aggressive forms of alien flora. However, it is necessary to monitor the appearance and behavior of new invasive species of wild plants every year. So the destruction and reduction of the number of species in this group will prevent the displacement of indigenous inhabitants from their natural habitat.

The basis for the protection of flora objects is carried out by Art. 18-25 of the Law of the Republic of Belarus "About Flora". The preservation and further enrichment of the biological diversity of wild flora can be achieved by creating botanical gardens, nurseries from their native genome and missing of external and internal changes in species generally, the organization of scientific research directed at increasing wild flora in different ways. The micropropagation, which allows plants to grow in their natural habitatis one of it. Expansion of areas for protection of endangered flora is under the control of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus.

Another important factor is the presence of organizations that actively study the plants and carry out educational work. This is an important link to the practical implementation of ideas to improve the quality of the environment and biodiversity replenishment. It is necessary to create biological clubs on the basis of kinder gardens and schools and clubs where the pupils will be able to fully understand the problem and continue to work in this direction.

Selmanovich O., Zhuk E.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE PRINCIPLES OF THE ORGANIZATION OF OUT-OF-CLASS WORK FOR THE FORMATION OF ECOLOGICAL COMPETENCES OF PUPILS

Out-of-class work plays an important role in the formation of ecological competences at school. The process of formation of ecological competences is inseparably linked with the educational environment of the subject “Biology”. Correctly organized out-of-class work helps to develop the potencial of pupils, to direct them on self-contained activity.The development of out-of-class occupations with an ecological bias can promote the formation of environmental awareness of pupils. Out-of-class activity gives an opportunity to experience a self-realization through research and science works, performance at conferences and participation in various actions. It is important because not all pupils have skills of public statements, and this work helps to develop these skills.

There is a variation of forms among interactive methods of teaching. Interactive methods promote the formation of cognitive activity of pupils, increase the interest of pupils in environmental issues, create comfortable conditions for teaching while all pupils actively interact with each other, activate search for the solution on questions based on the analysis of circumstances and situations, trust, creativity and cooperation.

The analysis of organization of out-of-class work programs in the educational "Ostrovsky comprehensive school of Lyakhovichy district" has showed the variety of forms of out-of-class work such as ecological circles, excursions and practice in the field, open classrooms, scientific research ("The assessment of anthropogenous impact on Ostrovsky's village council by the method of fluctuating asymmetry", "A research of water quality in the Ostrov village of Lyakhovichy district"), environmental movements ("Youth for purity of the cities and villages", "Sixty minutes for the planet"), school companies ("The week of ecology", "Harvest Day"), participation in conferences, tourist and local history work. The variety of methods of interactive education in out-of-class work creates necessary conditions for the formation of objective view at each pupil, promotes improvement of oratorical skill and ability to conduct a dialogue, helps to form research skills. Resolving an environmental education issues in the establishment of education is based on the principles of its systematic character, continuity and expediency.

Yanush V., Luchina V.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE ANALYSIS OF THE ENVIRONMENTAL AND LEGAL OUTCOMES OF THE 21ST CONFERENCE OF THE PARTIES TO THE UN FRAMEWORK CONVENTION ON CLIMATE CHANGE IN THE CONTEXT OF ENVIRONMENTAL AND ECONOMIC INTERESTS OF THE REPUBLIC OF BELARUS

Throughout the history of the Earth, climate has been changing all the time. But only the changes of the last decades, which are connected first of all with industry activities of the human are the reason of the trouble in the world communities. On the third United Nations Framework Convention on Climate Change in Kyoto on December 11, 1997 the Kyoto Protocol was adopted. This is an international document, which provides legal obligations for 38 industrialized countries and is designed to reduce greenhouse gas emission (approved by the Presidential Decree of the Republic of Belarus August 12, 2005 № 370). The main task of this Protocol is the motivation of developed countries and countries with transition economies in reducing harmful atmospheric emissions of carbon dioxide, methane and other industrial gases by 5% by 2012 in comparison with 1990. Belarusian legislation on the environment has some laws regulating legal relations that touch upon the Protocol of Kyoto: the Law of the Republic of Belarus "On the safety of the environment" dated November 26, 1992, the law of the Republic of Belarus "On the protection of the atmosphere" dated April 15, 1997, the law of the Republic of Belarus "On the protection of ozone layer" dated November 12, 2001, etc.

The obligations under the joining to the Kyoto's Protocol are quite consistent with economic development trends of our country: reducing energy intensity GDP; enhancing the part of natural gas to heating oil; enhancing the part of perpetual resources and unconventional energy resources.

The 21 Conference of the Parties to the UN Framework Convention on climate change and 11 Meetings of the Parties Protocol of Kyoto was being held from November 29 till December 12, 2015 in Paris. The result of these important international events is Paris is Accord, which will replace Kyoto Protocol after 2020. On September 20, 2016, the Republic of Belarus became the thirtieth country, which signed Paris Accord. The sides fixed the main purpose of this Accord that is to keep the increase of global temperature within the limits of 1.5 or less 2 degree Celsius by the end of the century. For resolving problems, which are connected with the climate change, the developed countries of the world agreed to allocate $ 100 million per year to emerging countries. Article 105 "International treaties" of the Law of the Republic of Belarus "On the environmental safety" states: "If international treaty of the Republic of Belarus establishes other standards of the environmental

protection than those which are provided in the present law we should use the norms of international legislation", that fixes some legal contradictions that may emerge. Paris Accord includes some flexible regulations, allowing the Republic of Belarus to use economic mechanisms in the feature to reduce emission of greenhouse gases and use unconditional advantages like high percentage of forest land, the presence of considerable water resources, essential part of bogs, and particularly protected natural territories. In addition, these provisions help to overcome the current impossibility of using Kyoto Protocol mechanisms such as the trade of quotas for greenhouse gas emissions, the implementation of joint implementation projects, and others.

Yasaite M., Platun E., Zhuk E.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE FORMATION OF ECOLOGICAL COMPETENCES OF THE TEACHERS WITHIN THE DISTANCE COURSE OF EDUCATION

The modern model of education in the context of professional development and additional education of experts assumes to modify the organization of studying process, the content of studies, and also alters the form and technologies of the learning process. At the present stage of society development, the new opportunities for education are opened by the virtualization of education environment. The virtualization process of education is caused by the rapid development of information systems that open new didactic and administrative opportunities for the perfecting\of the education system, and for the requirements of the education system to provide with quality and available education.

The process of formation of the teachers' competences is linked with the professional development of general education and professional levels of ecological competence.

The electronic system of distance learning Moodle was used for distance learning courses (the modular object-oriented dynamic educational environment). The courses allow to organize the distance learning and include a set of necessary tools for the development of distant courses. Within the international Tempus 543707-TEMPUS-1-2013-1-DE-TEMPUS-JPHES project "Ecological Education for Belarus, Russia and Ukraine", the programs for professional development within ecological education for school and college teachers were implemented. Two courses were implemented: for school teachers "Project Activity in Ecological Education of Pupils" and for college teachers "Practical Ecology within Realization of Distant Education".

A relevance of implemented courses is determined by increased value of innovative approaches to the process of ecological competences formation. The course program gives access to methodology to organize research projects and to create

competitive projects with the features of the requirements imposed to these works at various scientific competitions.

The course is focused on the formation of skills and abilities of the self-contained choice for research projects in order to select techniques of ecological research adapted for school (an experiment, observation in the field, model operation, etc.).

The common methodical questions for the implementation of research projects and learning the research techniques adapted for school from various scientific directions of ecology were included in the content of the course.

The offered programs with the use of the modern technologies give the opportunity to make the process of the formation of ecological competences of teachers efficient and practically oriented.

SECTION 2

MEDICAL ECOLOGY

Anisova A., Lazar I.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE EPIDEMIOLOGICAL ANALYSIS OF THE INCIDENCE RATES OF THE CHILD POPULATION IN SOLIGORSK, MINSK REGION

Relevance. Child health maintenance and recovery is one of the most important medical and national problems, successful solving of which will determine procreation and preservation of the genetic profile of mankind.

Work objective is conducting a retrospective analysis of child morbidity in Soligorsk in terms of nosologies, that occupy the leading positions in the child morbidity structure.

Object of study is the data on child morbidity in Soligorsk in the period of time from 2006 to 2014 as well as the data on the number of this group of population in Soligorsk within the period under study.

Results and discussion. The leading positions in child morbidity structure in Soligorsk account for respiratory incidence rates (84%). The sickness rate of other incidence rates is 16 %. According to the age structure of child respiratory cases, the highest share accounts for the group with the age 1-4 both at the beginning (39%) and at the end (43%) of the study period. The uncertain decreasing trend (R^2=0,5) is indicated in the long-term dynamic of nervous system diseases morbidity. The morbidity trend is A_1=-0,25‰ and within the annual average index A_0=5,3‰.

Significant differences in primary morbidity indices for respiratory, digestive, nervous system diseases, injuries and intoxication, congenital defects for some years were identified.

Conclusions. During the study period the structure of child morbidity has not changed essentially, except for the nervous system diseases, where it is shown.

Asatryan M.[1], Kokorina N.[1], Tkachenko A.[2]

[1] International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;

[2]City Clinical Maternity Hospital № 2, Minsk, Republic of Belarus

THE CURRENT STATE OF THE HEALTH PROBLEM OF THE CHILDREN CONCEIVED USING ASSISTED REPRODUCTIVE TECHNOLOGIES

Assisted reproductive technologies are widely used now for solving the problems of infertile couples. There is no doubt about the relevance of the infertility problem, despite the improvement of methods for correction of fertility disorders, and preparation of the couple. It is caused by the growing influence of technological, environmental and social factors on the processes of human reproduction. Current achievements of embryology and genetics determine the development of biomedical technologies to realize the reproductive potential of the couple in the case when an alternative medical treatment was ineffective.

In the past two decades, a lot of attention is paid to pregnancy outcomes, occurring after the treatment of infertile marriages with the use of IVF. Repeatedly it was noted that the use of this method leads to an increased risk of preterm delivery (especially in multiple pregnancies) and as a result, to prematurity and immaturity of children and increased perinatal mortality.

The aim of the work was to study the current state of the problem of children's health that were born with the use of assisted reproductive technologies. Studies were carried on the base of the City Clinical Maternity Hospital №2.

Results of the research. 34 women were surveyed and 40 stories of the development of the children that had conceived using assisted reproductive technologies (IVF) were analyzed.

The study found that in IVF group women's infertility was associated with severe gynecological diseases (97.1%).

In the majority of cases, pathological current of pregnancy in women (70%), which was associated with gestosis (32.4%), fetal hypoxia (14.7%), and multiple pregnancy (17.7%), threat of termination of pregnancy (5.9%)was observed.

Pathological current of pregnancy leaded to complications during labor (37%), which was accompanied by intranatal fetal hypoxia (16.4%) and preterm delivery (20.6%).

The studying of the children's health found that most were full-term (70%), but 35% had low birth weight associated with intrauterine growth retardation. 30% of children from the group were born in the result of preterm delivery.

In children of IVF group hypoxic conditions, intrauterine growth retardation were observed. Early neonatal period was complicated by neurological disorders and infectious diseases.

Evidence suggests that children conceived using assisted reproductive technologies, have a higher risk of various pathological conditions.

Batyan A., Zhitkevich T., Muha A.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE INFLUENCE OF LOW-INTENSITY LASER IRRADIATION ON THE LEVEL OF GLUCOSE IN BLOOD OF HEALTHY PEOPLE

The investigation of of healthy people in the applications of low-intensity laser irradiation (LILI) of different wave-lengths has been conducted in the research work.

Blood sampling was made from male research volunteers at the age of 20 – 24 in fasting state and also 10 minutes and 1 hour after the laser irradiation exposure. The level of glucose in blood was measured with the help of portable glucometer Bionime GM100 and capillary test-strips Rightest. Diode laser has been used in the research work. Dermal exposure was carried out on the bend of elbow region. The characteristics of laser exposure were as follows: wave lengths 635, 785 and 960 nm, laser power 1,1 mW, frequency 50–60 Hz.

We have found that marked impact on donors' level of glucose in blood generated irradiation with wave length 635 nm only, namely, 1 hour after LILI blood glucose level declined from 4,7 to 4,5 nmol/l ($p < 0,01$). There were no differences of this indicator compared with baseline levels in all other variants of exposure.

It is known that irradiation with wave length of 635 nm corresponds to the red light. Redox enzymes, enzyme-substrate complexes, erythrocytes, hemoglobin, oxygen can play a role of primary photoreceptors of laser irradiation of the red light.

Positive influence of LILI on rheological properties of blood has been elucidated: the decrease of erythrocyte aggregation and the increase of erythrocyte capacity to deformability. Tissue microcirculation improves due to enhancement of oxygen delivery zone and activation of aerobic metabolic processes as a result.

The impact of laser on blood is accompanied by conformational alterations of hemoglobin molecules and modification of the oxygen delivery function of blood. Oxygen affinity of hemoglobin is increased which promotes better tissue oxygenation, too.

Being photoacceptor of red laser radiation oxygen goes into singlet (excited) state thus stimulating oxidation processes in tissues. Sugars and fatty acids are metabolized herewith.

Near (785 nm) and far (960) infrared laser irradiation bands didn't have an impact on the level of glucose in the blood of the donor in our experiments. Dermal infrared exposure of laser is accompanied by local reactions of superficial vascular system, namely vasodilator, anti-inflammatory, analgetic, wound healing effects.

There is no data regarding influence of this type of irradiation onto redox processes in organism in scientific literature.

Consequently, dermal LILI in the red light facilitates the decrease of the level of glucose in the blood of healthy people presumably as a result of enhancement of reduction-oxidation processes in organism induced by optimization of oxygen delivery function of hemoglobin. The technique developed by us may provides additional measure to decrease hyperglycemia in patients with diabetes mellitus type II.

Belkovskaya E., Tyshin N.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

BYSTANDER EFFECT AS THE PHENOMENON OF THE TRANSFER OF INFORMATION

Bystander effect is a phenomenon of the transfer of information from irradiated cells to non-irradiated when cell damage (chromosomal aberrations, apoptosis, micronuclei,mutations, etc.) is observed in irradiated cells. This effect was reported in 1954 by Parsons, which showed that in children who were treated by irradiating of leukaemia spleen, there was damage of bone marrow. In the last 20 years a lot of information was received about "bystander" effect, but its nature and mechanisms are still not established.

In earlier work on this topic Nagasawa and Little irradiated the cells of Chinese hamster ovary with alpha particles at doses between 0,03 and 0,25 cGy, so that only about 1% of the cells were exposed to direct irradiation. However, chromosomal damage was observed in more than 30 % of the population. Thus, their data showed that DNA damage can be caused in a greater number of cells than in those which were exposed to radiation. It was unexpected and contradicted the model of direct damage.

It has been shown that exposure to 20 α-particles each of cell the 20% of randomly selected hybrid cells contributes to a threefold increase in the number of mutations compared with the expected. Experiments conducted by Assama and others showed that irradiation of alpha particles suppressed genes such as p53 and p21, involved in control processes of cell cycle and induction of apoptosis, and this process can be expressed in nonlinear form after irradiation with low doses of radiation.

A lot of research of "bystander" effect became possible with the use of microbeam, allowing a small amount of charge (light ions) to enter in a single cell nucleus.

Cellular reactions caused by using this effect include the induction of chromosomal aberrations, mutations, cell death, apoptosis (or programmed cell death), malignant transformation and genetic instability. Bishai demonstrated "bystander"

effect in a multicellular model with the help of a group of cells that were marked. Small distribution area of beta-particles only causes the defeat of labeled cells and unlabeled cells are not subject to radiation exposure. However, as a result, the unlabeled cells are also affected.

In 1997 K. K. Mazersil and Seymour found that the substances of the cytoplasm of the irradiated epithelial cells had a damaging effect on unirradiated cells. This fact proved that gamma radiation can cause "bystander" effect and opened a good way to study this effect in human cells. An intensive research on this phenomenon and, in particular, of its mechanisms began. There is evidence of at least two independent ways of information transfer from irradiated cells of non-irradiated: 1) through cell-cell interaction and 2) via the cellular factors that are excreted into the culture medium.

Bystander effects are measured by the induction of gross genome rearrangements, chromosome aberrations, sister chromatid exchanges, deletions, duplications, mutations and amplifications, and cell death.

Bystander effects were observed in the following cytoplasmic irradiation, demonstrating that the target for genetic events is not only the nucleus. Bystander effects also manifest themselves in the whole-organism context. Bystander effect is used in medicine for the treatment of cancer because besides efficient killing of targeted tumor cells, neighboring, non-transduced cells are killed as well.

Bichenkova M., Sinelyova M., Gritsai N.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

PROGNOSIS OF PATIENTS WITH ISCHEMIC HEART DISEASE AND HYPERTENSION

In the Republic of Belarus there is a high prevalence and intensity of human diseases associated with coronary heart disease and hypertension. The most common form of coronary artery disease is angina pectoris. Survival of patients with angina is characterized by the wide variability that is due to heterogeneity of patients in the observed groups. Left ventricular hypertrophy, hypertension, and congestive heart failure are the related factors which influence the life prognosis of the patients with angina.

The aim of the study is the disease course assessment and the prognosis of the patients with ischemic heart disease and with stable angina and hypertension.

The studies were conducted in Clinic 12 in Gomel on a sample of 40 patients diagnosed with "Ischemic Heart Disease: stable exertional angina. Hypertension". For risk assessment of fatal outcome of a cardiovascular disease, the SCORE scale (Systematic Coronary Risk Evaluation) has been used for 10 years to assess the impact of the existing risk factors and the baseline clinical and different instrumental parameters on the state of patients with the coronary artery disease.

According to the method, it is possible to identify 4 groups of risk of developing cardiovascular complications:

Group 1 or the group of low-risk means that the possibility of the development of cardiovascular complications in the following 10 years is less than 15%.

Group 2 or the group of average risk implicates the risk of complications in the following 10 years, and the risk is 15–20%.

Group 3 or the high-risk group stands for 20–30%.

Group 4 or the group of very high risk means that in the following 10 years the risk of complications is higher than 30%.

Risk Stratification is held separately for men and women.

According to the studies, the risk of cardiovascular complications for the entire sample is high and very high. What is more, in men 50% of patients have very high risk, while in women 25% is considered to be a very high risk.

Reliable indicators affecting the risk of severity were the functional class of angina, the degree of hypertension, the presence of concomitant cardiovascular diseases, and organ damage.

Bogdanova O., Ruta-Zhukovskaya E., Bokut S.

National Anti-Doping Laboratory, Lesnoy, Republic of Belarus;
International Sakharov Environmental Institute of BSU,
Minsk, Republic of Belarus

COMPARATIVE MASS SPECTROMETRY ANALYSIS OF HbA_1 AND HbA_2 HEMOGLOBIN TETRAMERS

Tetrameric human hemoglobin (HbA) is an ensemble of two dimers formed and a pair α- and β- subunits, each containing a heme *b* (Fe - protoporphyrin IX). The interest in the study of its properties is due not only to the huge role of hemoglobin in respiratory physiology, but also to the fact that, being relatively simple in structure, it serves as an excellent model for the study of nonlinear and cooperative interactions in proteins that are composed of several subunits.

The interest in the study of certain types and forms of human hemoglobin is determined by the diagnostic value as markers of a number of pathological conditions. Many important characteristicof pathological conditions are described, which is not only a change in the number of total hemoglobin in the blood, and the redistribution of the content of certain of its types.

In this paper, column anion exchange chromatography on DEAE-Sepharose was used for preparative amounts of principal (HbA_1) and minor (HbA_2) forms of human hemoglobin.

The results showed that in both analytical and preparative embodiments, isolation and purification of the main and minor forms of hemoglobin person order eluting forms hemoprotein and the main parameters of the chromatographic separation on a column of DEAE-Sepharose correspond to the characteristics of behavior of

hemoglobin in the allocation of the protein to column DEAE-cellulose, which indicates the possibility of using more accessible DEAE-Sepharose matrix to obtain purified forms of human hemoglobin.

Heterogeneity derived hemoglobin fractions was confirmed by proteomics «top-down» with the use of gas chromatography-mass spectrometry of high resolution. Deconvolution analysis of the mass spectra of the chromatographic separation of hemoglobin under denaturing conditions showed only the presence of subunits corresponding to the individual forms of the protein (Figure 1).

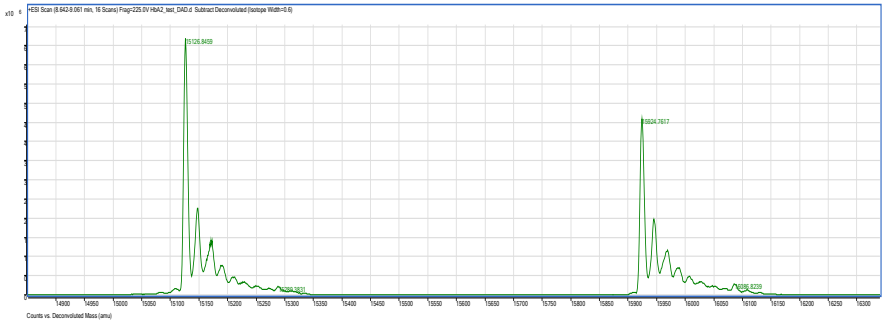


Figure 1. – The result of mass spectrum deconvolution minor peak shape in its hemoglobin HbA_2 chromatographic separation under denaturing conditions

Boika M.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

TOXICOLOGICAL CHARACTERISTICS OF HEXYL ESTER OF 5-AMINOLEVULINIC ACID

As a result of the development of protective and stimulating compositions for the treatment of seeds in agriculture a promising plant growth regulator hexyl ester of 5-aminolevulinic acid (H-ALA) with a pronounced growth stimulating properties against a number of crops was established at the Institute of Bioorganic Chemistry of the National Academy of Sciences. For the safe use of the H-ALA in the agricultural sector complete toxicological and hygienic assessment of the rationale of hygienic standards in the working area, air, water reservoirs, food, as well as calculation of the acceptable daily intake dose in humansmust should be allowed. The basis for such studies is the toxicological experiment on warm-blooded animals, which allows you to define the threshold of harmful action of chemical factors.

The research goal is to identify the major parameters of toxicity of hexyl ether of 5-aminolevulinic acid and products of plant protection based on it.

To evaluate the quantitative parameters of acute toxicity probit analysis according to the method of Litchfield and Wilcoxon, the crude product - hexyl ester of 5-aminolevulinic acid H-ALA and its formulation (3% H-ALA in DMSO) was determined.

The study of local irritant and skin-resorptive properties of the crude product in order to study the toxicity with cetaceous application of H-ALA in three series of experiments with the introduction of 50%, 25%, 5% (m / V) solutions of H-ALA were held.

The determination of the ability of fluorine to accumulate in the body was carried out by assessing the cumulative properties of substances by Y.S.Kagan and V.V.Stankevich. The experiments were performed on white rats to which the test substance is administered intraperitoneally in a dose of 0,1 DL_{50} within 1.0-1.5 months (on 5 times a week) control animals receive equivalent quantities of a solvent.

In the result of studies after a single intragastric administration of the mean dose DL_{50} H-ALA in mice (males) is 3000 mg / kg, rat (female) – 7800 mg / kg acute effect Lim_{ac} threshold set at mean effective dose ED_{50} (mouse) – 73 mg / kg. The value of the indicator of acute coverage is 41 (characterized as a substance with a wide zone of the toxic effect. In response to the massive doses of H-ALK (a total of 13 multiple DL_{50}) in mice adaptation of the test subchronic toxicity (accumulation factor of 6.1)occurs. H-ALA is weak irritating to intact skin and pronounced irritative effects on the eyes of rabbits (8 points).

In the study the formulation (3% H-ALA solution in DMSO) of the mean dose of intragastric administration was determined at 11,000 mg / kg. Weak irritant effect on skin and mucous eye were detected. Sensitizing properties are not available. Inhalation toxicity is not expressed.

Bolotnik V., Gritsai N.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE FEATURES OF MALIGNANT BREAST NEOPLASMS IN THE REPUBLIC OF BELARUS

In the last two decades there has been a considerable increase in the incidence of breast cancer in Belarus and in most developed countries. The problem is now becoming ever more relevant.

According to the World Health Organization about 1.38 million of new cases of cancer of this localization is revealed each year in the world. Breast cancer has the second place in the structure of cancer incidence in the female population in the Republic of Belarus (17.6%) and the first place (16.9%) in the structure of women's mortality from malignant neoplasms. It occurs in one in ten women of the Republic, and one in three die from this disease.

The aim of the study was to study the dynamics of cancer incidence rates of breast cancer in different age groups in the Republic of Belarus for the period from 1991 to 2014.

In the study of the epidemiological situation in the Republic of Belarus, it was determined that within 1991-2014 the incidence of breast cancer ranged from 39.2 in 1994 to 81.3 cases per 100 000 women in 2014, for urban dwellers it was from 42.2 per 100 000 in 1991 to 86.6 per 100 000 in 2014, and for rural population the number was to 33.2 per 100 000 in 1991 to 63.3 per 100 000 in 2014. Long-term dynamics of the disease was moderately tended to increase with an average growth rate of 1.85%. The growth of the average incidence was due to the rising incidence of women 60-74 years old, while the incidence levels of women of working age remained unchanged.

The age distribution of the disease had its own characteristics. The incidence of growth began with 25–29 years of age and continued until 60–64 years, and each subsequent year of life increased the risk of disease developing approximately to 5 cases per 100,000 women. Further with age the morbidity gradually decreased. The peak of breast cancer morbidity accounts for the age group of 60–74 years old.

In the analysis of morbidity in regions and in Minsk the highest incidence rate is observed in 2014 among Minsk residents (59.2 per 100 000 population) and the smallest one in Brest region (40.1 per 100 000 population), but no statistically significant differences in other regions of the country have been identified. When comparing the incidence of urban and rural residents it has been revealed that the incidence rate is higher in women of the city than in the village (1.6 times).

The increased incidence may indicate an improvement in the quality of diagnostics in identifying a larger number of patients in the early stages of the disease.

The control the growth of breast cancer is not possible due to the lack of effective ways of primary prevention. The early diagnosis of the disease is becoming more and more significant and may have influence mortality rates. The reduction in the mortality and morbidity ratio over the past decade gives evidence of the effectiveness of medical treatment.

Borisevitch M., Gritsai N.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE ANALYSIS OF THE DYNAMICS IN THE INCIDENCE OF RESPIRATORY DISEASES IN MINSK POPULATION WITHIN THE PERIOD OF 2006-2014

Timeliness. Respiratory diseases (RD) take the 1st place among other diseases. Every year there is an increase in the number of people with the given pathologies.

The objective is to study the dynamics and the structure of respiratory diseases morbidity, the air condition affecting the spread of the disease.

Objects and methods of research. The object of research is the statistical data on children's and adult's respiratory diseases in Minsk for the period from 2006 to 2014 as well as the official statistics of the Ministry of Health of the Republic of Belarus and the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus.

Results and discussion. The analysis of the dynamics of the overall incidence of adult and children population in Minsk showed that the structure of the overall incidence of adult and children population, RD in Minsk ranked first (62%, 77%) in 2006, then the eye diseases and the diseases of the musculoskeletal system follow with decrease (4%, 1%). In 2014, the structure of the overall incidence of adult and children population with RD continues to occupy the first place (23%, 66%).

The musculoskeletal system diseases moved to the second place (15%). The analysis of statistical series of the adult and children incidence of the respiratory system diseases in Minsk within 2006–2014 revealed an upward tendency to an overall morbidity (A_0 = 35 221,69, A_1 = 1.02%). It was also found that the children suffered from the diseases by five times more than adults. The analysis of the environmental impact on the incidence of respiratory diseases in adult and children population in Minsk within the period of 2006–2014 allowed determining the dynamics of the interrelation between the air pollutants emissions and the overall incidence of the respiratory system diseases. Spatial analysis of the interrelation of air pollution and the incidence of RD in adult population in Minsk showed a tendency to the total RD incidence with the increasing of air pollution.

Conclusions. There is the retrospective analysis of the population incidence which was held in Minsk for the period of 2006–2014. The correlations between the environment and the RD incidence of adult and child population were investigated . The tendency to stable growth in the incidence of the disease among adults and children was revealed. The analysis of the environmental impact on the morbidity showed the correlation between the dynamics of emission of air pollutants and the overall incidence of the respiratory system diseases.

Brutskaya M.[1], Kamlyuk A.[2], Kokorina N.[1]

[1] International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;

[2]Republican Scientific and Practical Center "Mother and Child" Minsk, Republic of Belarus

REPRODUCTIVE HEALTH OF COUPLES IN ASSISTED REPRODUCTIVE TECHNOLOGY PROGRAMS

The problem of infertility, regarded as a part of the physiology and pathology of the human reproductive function, is an important part of modern medicine. This is not only a medical, but also a social problem, which once again highlights its im-

portance. Assisted reproductive technologies (ART) give a real opportunity to manage the processes of human reproduction.

The successful outcome of ART depends not so much on the technical complexity and thoroughness of execution of microsurgical manipulation, but on the health of women with induced gestation and the fertility of her husband, as well as the primary causes of infertility and the number of implanted embryos.

The aim was to study the health status of reproductive function of couples in the application of ART.

The study provided data on patients suffering from infertility. The studies were conducted on the basis of RSPC "Mother and Child".

Results of the study. The health status of 40 couples suffering from infertility who used ART was analyzed. It was found that the risk factors for reproductive disorders in women are: age, burdened obstetrical history, endocrine pathology and inflammatory diseases of the pelvic organs. The factors for infertility in men include: oligospermia, astenospermia, teratospermia and azoospermia.

In studying the reproductive health of couples who used IVF, it was found that a major amount IVF-couples with female infertility factor at the age from 31 to 35, had a duration of infertility from 3 to 13 years (45%). The research showed that the main risk factors of reproductive health disorders in women are: age, burdened gynecological diseases, endocrine pathology and inflammatory diseases of the pelvic organs.

In studying the reproductive health of couples who used ICSI, it was found that male infertility was a factor in the investigation; astenospermia (40%), oligospermia (25%), terato spermia (20%), azoospermia (15%).

Studying the causes of infertility in female groups undergoing IVF and ICSI had found that the predominant cause of infertility in both groups was tubal-peritoneal factor as a result of the absence of one or both fallopian tubes after unilateral or bilateral tubektomia (40%). In comparative characterization of IVF and ICSI, it was found that the IVF method is fundamental in overcoming infertility when the female's reproductive health is compromised, as a result of tubal-peritoneal infertility factor (40%). The ICSI method is used in most cases with male factor of infertility (80%), as a consequence of astenospermia (40%).

Bulatovski A.[1], Rymko A.[2], Zinchenko A.[1,2]

[1] *International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;*

[2]*Institute of Microbiology, National Academy of Science, Minsk, Republic of Belarus*

THE CONSTRUCTION OF RECOMBINANT POLYNUCLEOTIDE PHOSPHORYLASE PRODUCING STRAINS

Among the most active and well-studied interferon inducers are double-stranded polyribonucleotides. For polyribonucleotides using polynucleotide phosphorylase (PNPase) that is an enzyme widely distributed among bacteria and catalyzes the polymerization reaction of some natural and modified nucleoside-5'-diphosphates.

PNP is necessary not only to produce interferon inducers, but it can also be used for the synthesis of pharmacologically important polymers containing modified nucleotides.

The aim of this work was to study the possibility of increasing the yield of the reaction catalyzed PNPase polynucleotide synthesis.

We used the bacteria *Enterobacter amnigenus* BIM B-245 as donor gene encoding PNPase, strain *Escherichia coli* BL21 (DE3) as an acceptor of a recombinant vector carrying a gene PNPase.

The PNPase gene was isolated from genomic DNA *Ent. amnigenus* by polymerase chain reaction. The amplification product was separated by electrophoresis on a 1.5% agarose gel, treated with restriction enzymes (*Nde*I and *Xho*I) and ligated into the vector pET24b(+), restriction at the same sites as PNPase gene. *E. coli* BL21 (DE3) cells was transforming the obtaining plasmid. Enzyme purification was performed using affinity chromatography on resin Ni-NTA. Enzymatic polyadenylic acid (poly-A) synthesis was performed using purified PNPase and adenosine-5'-diphosphate (ADP) as substrate. Thus different concentrations of enzyme and ADP were used.

In the result a new genetically engineered strain *E. coli* pET24b-pnp PNPase producer was received.

The results show the availability of recombinant PNPase for polyribonucleotides.

Chuholskiy A., Sinelyova M.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

CEREBRAL PALSY IN THE CHILDREN IN SOLIGORSK DISTRICT

Cerebral Palsy (CP) is a serious disease of the nervous and musculoskeletal systems, the main manifestation of which is the violation of the supporting and locomotor functions. The incidence of cerebral palsy in recent years tends to increase and leads to permanent disability in patients in 70% of cases.

In Belarus, cerebral palsy (CP)is 2.7 cases per 1000 child population in the overall incidence. The disease, according to the shape, is characterized by a disturbance of intelligence, speech, hearing loss, and a presence and convulsive hypertensive syndromes of various degrees of arbitrary restriction limb motility. Unfortunately, even promptly launched a comprehensive rehabilitation of children with cerebral palsy, can not completely restore the broken functions.

Objective - To study the incidence of cerebral palsy in children 0-17 years old in the town of Soligorsk and Soligorsk district. The paper presents an analysis of the incidence of cerebral palsy structure as an example of US "Soligorsk CRH" for 2013–2015.

It analyzed the prevalence of individual clinical entities. It is shown that assessment of the effectiveness of rehabilitation of children with cerebral palsy in Soligorsk and the Soligorsk district.

In Soligorsk and Soligorsk district on 01.01.2015, the population of children from 0 to 17 years is 26 566. On a neurologist registered member is 275 people, including up to a year – 18 with cerebral palsy in the area of 63 human children and adolescents (68% of the number of disabled children with neurological diseases).

The leading form of cerebral palsy in Soligorsk district, for the period 2013-2015 is a double hemiplegia, which is 34% of the total number of cases (for the period of 2015.). Then there is spastic diplegia - 28% of the total number of cases (for the period of 2015). Hemiparetic and atonic-astatic form of cerebral palsy is 26% and 12% inclusive.

Children from 1 to 15 years old make up the majority of the total number of cases: 87% at 01.01.2016.

Comparative analysis of the incidence of CP of Soligorsk district and the Republic of Belarus in general did not show significant differences in quantitative terms and in the dynamics of incidence change.

Drozd M., Puhteeva I.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE MEMBRANE EFFECT OF GLUCOCORTICOID HORMONES

Any cell of an organism performs the specific biological functions which are implemented by means of interaction of an extracellular incentive (primary messenger) with a receptor on a surface of a cell and signal transmission in a cells.

Glucocorticoid hormones are regulators of a wide range of the processes proceeding in an organism such as temporary use of a metabolic homeostasis, proliferation of cells, anti-inflammatory and immune response, ontogeny, reproduction and behavior. Glucocorticoids are primary intermediaries that are moved by means of a blood flow from an organ where they are made to an organ which they regulate and unlike many other hormones, are capable to get in a cell. Their action in a cell is implemented through linking with protein receptor of glucocorticoids that is a transcription factor from superfamily of nuclear receptors. That finally causes quick opening of an ion channel and an entrance of ions to the cell.

The purpose of the presented work is the research of structural changes of plasmatic membranes of cells of immune system at action of a synthetic analog of glucocorticoid hormones of dexamethasone.

Research object in work are thymocytes (a thymus cells) of experimental animals.

The analysis of a structural condition of membranes of thymocytes in experiments is carried out pyrene by means of the fluorescent probe. At the same time indicators of polarity and microviscosity of lipids of plasmatic membranes, and also extent of suppression of thriptophane) fluorescence were estimated.

The most expressed changes were observed in the area the annulyarnykh of lipids, microviscosity in this area was enlarged by 1,5–2 times depending on time of an incubation and concentration of dexamethazonum. The augmentation of an exponent of suppression of albuminous fluorescence on average for 50% can be bound to the fact that influence of glucocorticoids causes changes of a conformation condition of membranous proteins as due to change of aggregation of albuminous molecules and their immersion in depth of a lipide component, and owing to modification of protein – lipids interactions in membranes of thymocytes.

Thus, it is established that glucocorticoid hormones, interacting with membranes of thymocytes, cause change of their physical and chemical characteristics: indicators of polarity and microviscosity of lipids of various areas of membranes.

Gerasimovich A.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE FUNCTIONING OF THYROID SYSTEM IN THE CASES OF A SYSTEMIC SCLERODERMA

Not long ago the systemic scleroderma (SSD) was among relatively rare rheumatologic pathologies, but nowadays the number of cases of SSD has significantly increased. In recent years, significant progress in the study of pathogenetic mechanisms of systemic sclerosis, clinical study and course of the disease, diagnosis, development and creation of pathogenetic therapy programs has been done.

The development and course of SSD is associated with the changes in general and immunological reactivity, complex enzymatic and metabolic shifts in the regulation of which the endocrine system plays an important role since hormones take part in all metabolic processes, immunogenesis, cell membrane permeability, ion transport, protein synthesis, and activity of enzyme systems.

The thyroid hormones are considered to be regulators of trophic functions of the body, metabolism, and influence the adaptive processes. Thyroid hormones increase the activity of metabolic processes, regulate the processes of development, maturation, specialization and update almost all tissues of the body, and have a more pronounced effect on cell division than on their recovery, they also stimulate lipogenesis, gluconeogenesis and glycogenolysis, and etc. Thyroid hormones increase both the resorption and the synthesis of bone proteoglycans and glycosaminoglycans in the production of connective tissue. Excessive concentration of thyroid hormones enhances the inflammatory response and metabolic disorders.

Therefore, based on these facts, the purpose of the study was a quantitative determination of thyroid hormone status in the control group and in patients with SSD.

Thyroxine, triiodothyronine and thyrotropin were determined by using kits for immunological analysis of the blood serum of healthy humans and patients with SSD.

It is shown that the content of thyroxine, triiodothyronine and thyrotropin in blood serum of healthy subjects was 110.1±9.2 nmol / l and 1.6±0.1 nmol / l and 7.9±1.4 mIU / L, respectively.

In cases of scleroderma the thyrotropin and thyroxine levels in blood were reduced by 21.3% and 6.3%, respectively, particularly the latter, and triiodothyronine concentration was not changed.

These facts indicates that the function of the thyroid system in cases of scleroderma is oppressed and the developing disturbances in the body's immune system can occur. Using the definition of thyroid status will improve the diagnosis of SSD and will provide additional opportunities to evaluate the dynamics of the disease.

Gribovich R., Kamlyuk A., Kokorina N.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ANALYSIS OF HEALTH AND PREGNANCY OUTCOME OF PATIENTS OF IVF PROGRAM

Method of in vitro fertilization (IVF) today is an effective method of treating infertility and it helps even in the most hopeless situations. One of the causes of pregnancy complications after the use of IVF is multiple pregnancy, which occurs more often after art than in the population. Multiple pregnancy can be considered a model of fetoplacental insufficiency, and the number of complications for mother, fetus and newborn, it belongs to the high risk pregnancy. Multiple pregnancy in IVF occurs more frequently than in the population and is associated with the transfer into the uterus of more than one embryo. The aim of this work was to study the health status and pregnancy outcomes of the patients of the IVF program at the various etiological factors of infertility.

The following tasks are solved:

- the state of women's health IVF program is studied
- the outcomes of single and multiple pregnancies after IVF are analyzed. Material studies provided data on patients suffering from infertility. The studies were carried out on the basis of the RSPC "Mother and Child".

The results of the study: analysis of the health status of 35 women with infertility and their 48 children born through IVF, which in turn were divided into 2 groups. The first group included 23 women whose pregnancy ended with the birth of a single child as a result of IVF.

In the II groupthere were 12 women with multiple pregnancies after IVF and 25 children. It was found that risk factors for reproductive health disorders in women are age, obstetric anamnesis, endocrine pathology, inflammatory diseases of the pelvic organs. The leading cause of infertility in women entering the IVF program, was endometriosis (24%) and endocrine infertility (24%). In the duration of infertility, the methodology is used for carrying 2–3 embryos, increasing the likelihood of multiple pregnancy after IVF: 7–9 years in 100% of cases and for a period of 12 years – 50%, respectively. When evaluating the health status of infants in groups I and II of the IVF program found that in II-nd group, the frequency of low birthweight children was higher by 44% than in the first group – 4%. In women of group II ECO the number of extremely premature (less than 1500 g) children was higher than in the I-th group (20% and 4,35%). At term pregnancy, number of children II-nd group with low body weight at birth (12%), in the I-th group is not observed. The number of newborn children II-nd group with asphyxia was more than newborn children of the I –th group (24% and 4.3%).

Neurological disorders post hypoxic condition, syndrome, cerebral ischemia, syndrome of minimal brain dysfunction in the II-nd group is 2.5 times more than in the I-th group (56% and 21.7%).

Thus, multiple pregnancy after IVF is more risky than a singleton pregnancy.

The result of this research is to support the transfer of a single embryo, which allows to minimize the risk of complications of multiple pregnancy.

Grivusevich V., Ablecovscaya O.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

A QUALITATIVE ASSESSMENT OF THE NUTRIENT COMPOSITION OF THE STUDENTS' DIET

The problem of healthy nutrition is one of the most important nowadays, especially for students that is specific professional group characterized by specific conditions of work and life (chronic sleep deprivation, infringement of a mode of day and rest, nutrition and intensive information load, etc.). In addition, the age of 18–20 can be characterized by the incompleteness of the processes of growth and development of an organism in such way that everything together can promotethe formation of the premorbid states and, in some cases turning into pathological processes or exacerbate existing disease. For example, it can lead to negative consequences for the Central nervous system (mental breakdowns), digestive tract (gastritis, peptic ulcer disease), cardiovascular system (hypertension) and it may contribute to the development of obesity and diabetes of the 2nd type, which increases the risk of atherosclerosis, coronary heart disease, and related complications such as heart attack and stroke.

The objective of the work is to assess the nutrient composition of the students' dieting.

The object of the research are the students aged 18–20 from different Universities of Belarus. The study involved 27 people. The male sample consisted of 7 people, female included 20.

The method of 24-hour reproduction of a daily diet for 3 days, one of which was a holiday, was applied to a study of the actual nutrition (during the spring period). Everyone surveyed kept the diary of food within 3 days, writing down the name and quantity of the eaten dishes and products after each meal. When carrying out a research special attention was paid to the sources of proteins, fats and carbohydrates.

Qualitative analysis of the consumed food showed that receipt of proteins happens generally at the expense of animal products (the main source of irreplaceable amino acids) which are chicken dishes, dairy products, eggs. Respondents practically didn't take in vegetable protein (in isolated cases it was buckwheat cereal and

haricot). Protein component supply tends to exceed the recommended age norms (especially in men).

As for the source of fat in the diet, the predominance of saturated fatty acids, obtained mainly from food of animal origin was observed. Fat intake meets the recommended norm.

Analyzing food from the menu for assessment of quality and amount of the consumed carbohydrates, the decrease in their quantity among men for 42% of the recommended norm and for 36% among girls should be noted. At the same time all respondents consumed, approximately in equal quantities, so-called "slow" and "fast" carbohydrates. Among "slow" carbohydrates in a diet were grits, buckwheat, vegetables, fruit, and among "fast" carbohydrates were pasta, chocolate, bakery products, potatoes dominated.

Thus, the obtained data demonstrates that the nutrient structure of a food allowance of respondents differs from standard indicators. Proceeding from it, it is also possible to assume insufficient intake of vitamins into organisms of the interviewed students.

Gusak C., Romanovskaya T.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE ROLE OF AGE AND LYMPHOTROPIC INFECTION IN THE FORMATION OF EXPERIENCE BODY IMMUNE

The composition of the peripheral blood lymphocytes has a unique feature – it is composed of lymphocytes, generated by lymphopoiesis (naive lymphocytes), and lymphocytes formed during immunogenesis within clone antigen (stimulated lymphocytes and memory lymphocytes). The ratio of naive lymphocytes and memory lymphocytes refers to an important integral indicators of evaluating the formation of immunological experience of the body and aging or deterioration of the immune system.

There is an attempt to evaluate the role of age and lymphotrophic infection as the most important factors of influence on the immune system in the presented investigation. Groups of examinees were formed to that end: group 1 – clinically healthy donors (a control group), group 2 – a group of individuals with HIV infection (a group for tracking the process of superantigen stimulation and the inhibition of lymphopoiesis), group 3 – the elderly group made up of individuals older than 75 years old (a group to monitor the impact of age-related changes). It was assumed that this approach would clarify the features of the ratio of naive lymphocytes and memory lymphocytes of age and infectious nature, that is to establish the role of immunological experience in the immune system.

To implement this goal peripheral blood was used, the lymphocytes of which were typed by the reaction of direct immunofluorescence for expression of CD45RA and CD45RO molecules.

The study of the content of naive lymphocytes and memory lymphocytes among the representatives of the three groups of examinees has revealed a number of important differences. Clinically healthy people (a control group 1) are different from the comparison group for higher presence of naive lymphocytes, reflecting the sufficiency of lymphopoiesis (the comparison is significant ($p < 0.005$). In the other two groups (HIV-infected individuals and people older than 75 years), this index is lower. But the mechanisms of lymphopoiesis limitation are different: in the presence of HIV-infection they are provided with the influence of HIV on hematopoietic cells. This observation is consistent with the other researchers' findings who conducted the study as part of the features of HIV infection and changes in the immune system during human life.

The study leads to the following conclusions:

1. Summary immunologic experience, manifested by the presence of memory lymphocytes accumulates over time.

2. The presence of chronic lymphotropic infection (HIV) does not show the formation of an immunological total experience, and leads to lymphopoiesis violation, i. e, the reduction of the number of "naive" lymphocytes.

3. Summary immunological experience is formed by opposite parity changes – a decrease in the number of "naive" lymphocytes and an increase in the number of memory cells.

Huliuta I., Shynhel A.

Establishment of Health National Anti-Doping Laboratory, Lesnoy, Republic of Belarus

STUDY OF ANABOLIC AGENTS METABOLISM USING IN VITRO SYSTEM OF HUMAN HEPATOCYTE CELL LINE

Abuse of anabolic steroids is one of the most important issues in sports. In doping control the detection of steroids is performed on the basis of urinary steroid profile, and the knowledge of it is very important to provide accurate control. Metabolism studies are usually performed by collecting urine samples after administration by volunteers of the steroid (excretion study). During last years human hepatocyte cell line has become a widely used system for metabolic studies since in vitro drug metabolism studies serve as a convenient screening mechanism to investigate drug metabolites.

The aim of this study is to clarify the suitability and possibility of using the in vitro system (human hepatocyte cell line Hep G2) for identification and separation new anabolic drug metabolites and compare the results with in vivo investigations.

For the detection of known metabolites present in a routine doping analysis target GC-MS/MS was used. In order to identify the maximum range of possible products of hepatocytes metabolism we applied the high resolution LC-MS (orbitrap) with full scan mode and LC-MSn for structure clarification.

Initially, to test the metabolic activity of the cell lines the study is concentrated on the phase I metabolites of the endogenous anabolic steroid – testosterone. We have identified both major metabolites (androstenedione, androsterone, etiocholanolone etc.) and rare minor metabolites. Subsequently, metabolic profiles of two exogenous anabolic steroids - oxymetholone and methandienone – have obtained.

Comparison of the results with studies in vivo showed the presence of the majority of known metabolites. At the same time number of metabolites were revealed which are the intermediate forms, as well as rare isomeric forms.

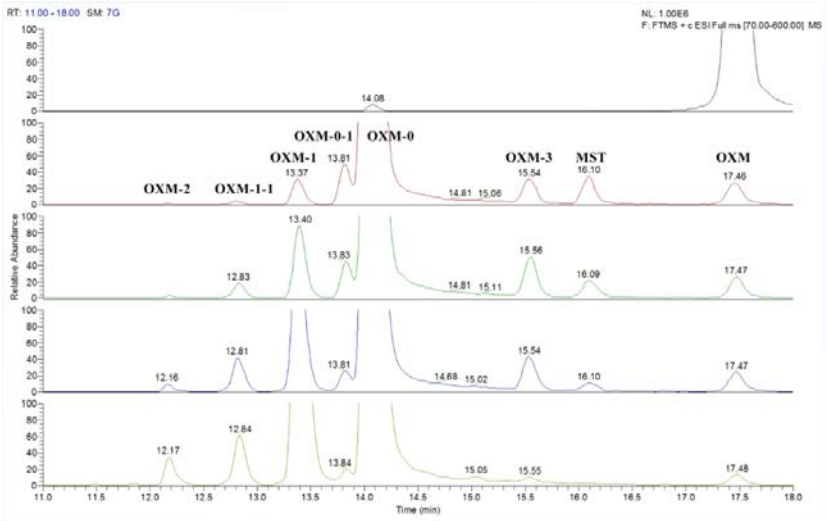


Figure 1. – High resolution LC-MS analysis of the hepatocyte culture incubated with oxymethalone for 15 min, 2, 4, 8 and 24 hours

Further identification of these forms in the frame of in vivo studies may provide additional mechanisms to enhance long-term drug control of prohibited substances in sports.

Isachenko E., Nikonovich S., Melnov S., Nadyrov E.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

KARYOLOGICAL PECULIARITIES OF CELL POPULATIONS IN THE THYROID GLAND IN PEOPLE EXPOSED TO RADIATION

As a result of the Chernobyl disaster radionuclides were released to the environment what led to radioactive contamination of the territory. Two radionuclides, shortlived 131I and longlived 137Cs, contributed a lot to the dose of radiation exposure of the population.

The aim of this research is to study nuclear abnormalities with internuclear chromatin bridges in thyrocytes of papillary thyroid cancer in patients of Gomel region.

Cytology studies were conducted on smears of thyroid biopsy samples acquired by diagnostic thyroid puncture. Smears were air-dried and fixed with Leishman stain. Then they were stained with azure-2eosin by Romanovsky. Incidence of thyrocytes with internuclear chromatin bridges was defined on 500-1000 cells. Studies were conducted in two groups of patients. The first group included 35 patients from Gomel region. All the patients were exposed to radiation in their childhood or adolescence in April - May of 1986 as a result of the Chernobyl disaster. In 1986 after the Chernobyl disaster radiation exposure dose on thyroid was measured in all 35 patients. Calculated absorbed exposure dose made up 1.2 Gy on average. The average age of Gomel patients at the time of the disaster made up 8.9±1.7 years old. The average cancer incidence in the studied group made up 13.8±1.8 years. The comparison group included 25 patients from Leningrad region whose pathohistological diagnosis was papillary thyroid cancer. In comparison to patients from Gomel patients from the comparison group didn't have any documented information that they were exposed to radiation in their medical history except for medical diagnostic tests. The average age of the comparison group of patients made up 45 years old (from 21 to 63), where there were 16 women and 9 men. Statistical data processing was carried out with a help of advanced analytics software package Statistica 8.0.

Internuclear chromatin bridges in thyrocytes were mainly found in binuclear cells, as well as between mononuclear cells being a part of cell complexes. They represent chromatin cords of different width and length which connect cell nuclei. The colour and structure of bridge chromatin corresponded to cell nuclei they connected.

Thyrocytes with bridges were present in 31 out of 35 patients from Gomel region. Most patients had 2‰ of thyrocytes with bridges. The average frequency of thyrocytes with bridges was 4.69±0.69‰. In the comparison group the incidence of thyrocytes with internuclear bridges didn't exceed 2‰. Thyrocytes

with bridges were not found in 50% of these patients. The average incidence of thyrocytes with bridges in the comparison group made up 1.10±0.23‰ and was statically lower in comparison to Gomel group of patients ($p < 0,0001$, according to the Mann-Whitney criteria).

Thus presented results give the evidence that cell populations of thyrocytes in papillary thyroid cancer in Gomel region residents exposed to the release of radio iodine isotopes following first moths of the Chernobyl disaster are characterised by an increased incidence of internuclear bridges in comparison to the comparison group from Leningrad region. Apparently, clonogenic cells which gave birth to malignant tumours in Gomel patients could appear to be geneticall-ly multiabberant cells as a result of radioactive effect of iodine and have increased genomic instability.

Karpovich A.[1], Kamlyuk A.[2], Kokorina N.[1]

[1] International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;
[2]Republican Scientific and Practical Center "Mother and Child" Minsk, Republic of Belarus

CONGENITAL MALFORMATIONS: FREOUENCY OF OCCCUERRENCE, PRINCIPLES OF EFFICIENCY AND PRENATAL DIAGNOSIS

The study of the epidemiology of congenital malformations (CDF) is an actual problem of modern medicine. CDF occupy one of the main places in the structure of causes of stillbirth, infant and neonatal morbidity and mortality, childhood disability. The etiology of congenital malformations is heterogeneous and is associated with chromosomal abnormalities, gene mutations, environmental factors.

It is well known that adverse environmental factors contribute to complications of pregnancy and childbirth, physiological disruption of the relationship between the parent organism and the fetus. The result may be various forms of anomalies and malformations.

Given the widespread growth of hereditary diseases, making a significant contribution to the morbidity, disability and mortality in the population, as well as ekozavisimost CDF, in many countries, including the Republic of Belarus, specialized registries to study the frequency and dynamics of the CDF are established. These registers provide an opportunity to establish the appearance of new teratogens in the environment, provide an estimate of the necessary medical care for congenital and hereditary diseases, to evaluate the effectiveness of preventive measures.

According to the Belarusian register CDF in strict accounting group includes: anencephaly, spinal hernia, cleft lip and / or palate, polydactyly, reduction defects of limb, atresia / stenosis, esophageal atresia / stenosis of the anus.

The aim of the work was to study the incidence of congenital malformations in the Republic of Belarus; assessment of the effectiveness analysis of prenatal diagnosis in reducing the frequency of birth of children with this pathology.

Results of the study. To carry out their own research and analysis of the incidence of congenital malformations was analyzed 60 cases with congenital malformations identified in 2015.

We have found that the greatest number of cases, according to the RSPC "Mother and Child", accounted for congenital heart disease (CHD), which accounted for 65.0% (39 cases of occurrence of 60) and multiple congenital malformations (chromosomal abnormality) – 11.6% (7 out of 60 cases of congenital malformations). Of the 39 cases of CHD accounted for most of the VSD, which accounted for 17 cases out of 39 (43.5%).

During the analysis, it was found that in 12 of the 60 cases identified chromosomal disease that was 18.3%. Most frequently occurring chromosomal abnormality was Down's syndrome – 11, 67%.

During the analysis, it was found that in 12 of the 60 cases identified chromosomal disease that was 18.3%. Most frequently occurring chromosomal abnormality was Down's syndrome – 11, 67%.

Kisel D.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE ANALYSIS OF THE TUBERCULOSIS INCIDENCE AND MORTALITY OF THE POPULATION OF THE REPUBLIC OF BELARUS IN 2006–2014

Tuberculosis (TB), which is caused by the bacteria Mycobacterium tuberculosis is an infectious disease which predominantly infects the lungs. The problem of tuberculosis is that it forms very high levels of morbidity, disability and mortality, while at the same time is potentially preventable. That is why risk of acute illness is increased, which is connected with the threat of life for the chronically patients and the elder population.

The international targets for tuberculosis control, framed within the United Nations' Millennium Development Goals, are to ensure that by 2015 the global TB incidence rate is declining and the global TB prevalence and death rates for 1990 are halved. These targets are to be achieved by implementing WHO's Stop TB Strategy (founded on the core DOTS strategy), central to which is the prompt diagnosis of patients with active disease followed by supervised, short-course, combination chemotherapy.

Belarus is among the 27 high multidrug-resistant tuberculosis (MDR-TB) burden countries in the world with the highest level ever recorded. In 2010–2011, a countrywide anti-TB drug resistance survey supported by WHO revealed 32%

and 76% of MDR-TB among new and previously treated smear/culture-positive TB cases, respectively.

The aim of this study was to analyze of the dynamics of tuberculosis incidence and mortality of the population of the Republic of Belarus.

The object of research is the data on tuberculosis incidence and mortality of children and adult population of the Republic of Belarus for the period 2006–2014.

Cases of TB (in all its forms) reported annually to Ministry of Health of the Republic of Belarus were used to calculate trends in incidence rate, the latter expressed as the number of cases notified annually in a given country per 100 000 population. The single outcome variable used in this analysis was thus the annual rate of change in the TB incidence rate.

The retrospective analysis of the tuberculosis incidence and mortality of the Republic of Belarus of the population for the period 2006–2014 was carried out.

It was shown the tendency to decrease of the tuberculosis incidence rate order for the period 2006–2014 ($R^2 = 0,96$). Among the rural population the active tuberculosis incidence rates were within 55,4–70,8 per 100 000 population. The minimum active tuberculosis incidence rate among urban population was recorded in 2014 (28.5 per 100,000 population), and the maximum – in 2006 (46.2 per 100,000 population).

The analysis of the dynamics of tuberculosis mortality showed that in 2006 among causes of death from tuberculosis bacteriologically confirmed TB cases took the first rank takes (75%), followed by not bacteriologically confirmed TB cases (8%), meningococcal infection (1%) tooks the third rank. In 2014 respiratory bacteriologically confirmed TB cases increased by 8 per cent, not confirmed bacteriologically TB cases decreased by 4 per cent. Meningococcal infection was increased by 1 per cent point and other forms of tuberculosis decreased by 5 per cent.

Kopach N., Zhegalo T.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

DETERMINATION OF *VITAN* PESTICIDE TOXICITY CLASS AND PARAMETERS OF ITS TOXIC EFFECTS

Modern agricultural policy of the Republic of Belarus provides for the development of measures to increase agricultural production and gives high priority to the protection of chemical plant products, which possess high economic effect that provides a permanent increase in their manufacturing. Pesticides with its high biological activity may have a negative impact on the environment and pose a risk to human health. The assortment of plant chemical protection agents is annually updated in the world. It is constantly updated with more effective and less dangerous environmental agents. The company is actively searching for their optimal forms, convenient to store, their use and less dangerous for users. Particular attention is be-

ing given to the study of pesticides toxicity classes and the impact of these substances on animals and humans.

The purpose of the work is to determine the parameters of the acute oral toxicity of the *Vitan* insecticide formulation, to assess the cumulative effects of the pesticide.

The acute poisoning was modeled by a single injection of the drug into the stomach of white rats using a needle probe. Different concentrations of the drug solution in DMSO were used during the experiment. The administered doses were calculated from the active ingredient, they didn't exceed the volume of physiological capacity of stomach. In acute experiments each dose was tested at 6-12 animals with subsequent observation for 14 days, given the nature of the symptoms of intoxication, the number of dead animals, the time of their death.

Research has shown that a single administration of the formulation of *Vitan* insecticide in the stomach of white rats the lethal dose (LD_{50}), calculated by probit analysis of Litchfield and Wilcoxon, is 387 (141,6 ÷ 415) mg / kg.

The cumulative properties of the insecticide *Vitan* formulation were observed on males of white rats, which 5 times per week for 30 days were administered with intragastric drug solution in dimethylsulfoxide (DMSO) at a dose of 38,7 mg / kg, equal to 1/10 LD_{50}.

Based on the results of this study, we can conclude that the studied formulation of *Vitan* insecticide, according to the parameters of acute intragastric toxicity, belongs to III class of toxicity (moderately hazardous substances), according to GOST 12.1.007-76 classification. The formulation of the *Vitan* insecticide does not possess cumulative properties at the level of manifestation of lethal effects (accumulation factor is more than 5), but the general toxicity is shown with preferential features of hepatotoxic effects (a significant decrease in protein concentration, creatinine in blood serum with enzyme activity of aspartateaminotransferase and alkaline phosphatase inhibition were observed).

Kovsh A., Shpadaruk K., Smoluakova R.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

MOLECULAR-GENETIC FEATURES OF GASTRIC CANCER

Due to the deterioration of the ecological situation in the world the number of malignant diseases has increased. Today, gastric cancer (GC) is the fourth largest in the world among oncological pathologies on the occurrence, giving tumors of lung, breast and colon cancer. Every year GC affects about 1 million people.

We can only talk about the role of predisposing factors in the origin of the disease that include etiologic nature of the disease, as well as molecular-genetic features of the organism. Some patients can be detected hereditary character of disease. Consider some of the molecular-genetic characteristics of gastric cancer.

CDX2 is a transcription factor relevant to the intestinal organogenesis. CDX1 process involved in the proliferation and CDX2 – in epithelial differentiation. It is shown that CDX2 serves as many intestinal transcription factor genes. Loss CDX2 may signal tumor progression in cases of early gastric cancer and cancer of the intestinal phenotype. Reducing the expression of CDX2 full intestinal metaplasia, with gastric dysplasia and gastric cancer suggested that CDX2 plays anticarcinogenic role.

A receptor of epidermal factor of height of man (HER2) is an important biomarker and one of key elements of carcinogenesis at the cancer of stomach. Disturbance of a regulation of the alarm ways can result from hyperexpression HER2 – receptors. It in turn results in a failure in the processes of cell proliferation, apoptosis, angiogenesis, and as a result – to progress of tumour process.

Hyperexpression Ki-67 is characterized only for proliferating cells. This marker characterizes aggression, malignant tumor process flow and probability of the response to the carried-out therapy. In the analysis of a prognostic significance of an index of proliferative activity it is shown that the high level of proliferative activity predicted worsening of disease-free and overall survival of patients with gastric cancer.

RUNX3 is a gene, which codes the protein, which relates to the family of transcription factors. The loss or considerable reduction in the expression RUNX3 of protein with GC is meant associated with the low survival of patients.

COX-2 is the key enzyme participating in formation of prostaglandins from arachidonic acid, and also involved in process of carcinogenesis. Thus, COX-2 plays a role in development of intestinal GC form, and its hyperexpression is associated with metastases in the lymph nodes and the negative outlook of a course of a disease.

Patients suffering from gastric cancer with the detected phenotype: hyperexpression HER/2, Ki-67, COX-2 and the absence of any hypoexpression CDX2, RUNX3, is observed most aggressive course of the disease and the adverse forecast. Thus, as a result of the study of molecular and genetic characteristics of the tumor GC, it is possible to predict the course of a disease, and also to individualize tactics of treatment of patients.

Kuznetsova E., Sinelyova M.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE STATE OF MEDICAL AND SANITARY CARE FOR THE RURAL POPULATION OF THE REPUBLIC OF BELARUS

The human health is the most important priority of national policy of the Belarusian state. The state pays special attention to system of health protection, strengthening of its material and technical resources. In recent years the Belarusian

medicine shows considerable progress in the development of perspective methods of prevention, diagnostics and treatment. Advanced technologies are accustomed, new medicines are created.

Medical care for a rural population is built on the basic of the principles of the organization of health care, however the nature of resettlement, the features of rural economics, the specifics of working conditions and life, and also other factors that influence nature of medical care and demand care of application of special organizational forms and methods of work in the village from health-care agencies.

The purpose of present work is to give an assessment to a condition of the medical and sanitary help to country people of Republic of Belarus.

The analysis of data of National statistical committee of Republic of Belarus and Sector of methodology and medical statistics of the Ministry of Health of RB about a condition of health system in the village has been carried out.

The number of the health workers having the higher medical education in Republic of Belarus has increased from 1995 to 2014 by 7,8% has made 57,8 on 10 000 population. The number of health workers with secondary education has increased from 1995 to 2014 by 1,6% and has made 131 on 10000 population.

The number of the hospital organizations in city settlements remains practically at one level from 2010 for 2014 (for the end of 2014 – 388) while in rural areas the number of the hospital organizations has decreased from 2010 to 2014 by 10,1% and for the end of 2014 has made 238.

There is a growing outpatient – polyclinic organizations in urban areas from 2010 to 2014. (6% at the end of 2014. The number of 649 organizations). In rural areas, there was decrease in the number of out-patient – polyclinic organizations (decreased by 1.9% at the end of 2014 amounted to 810.). The number of first-aid and medical stations in rural areas, which are the main link in the health care system in rural areas decreased from 2010 to 2014 by 7%.

Lobay M.[1], Ikonnikova N.[1], Puchkova T.[2]

[1] International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;
[2]Belarusian State University, Minsk, Republic of Belarus

BIOCHEMICAL CHARACTERISTICS SUBMERGED MYCELIUM OF FUNGI OF THE GENUS *CORDYCEPS*

Fungi of the genus *Cordyceps* are a traditional medicament and solution of prevention West medicine for many centuries. The combination included in the composition of this medicinal fungus, improve the immune system, increase resistance to various pathogenic microorganisms, have anti-tumor effect, increase the adaptive possibilities of the body, have antioxidant activity, prevent premature aging. In nature, fungi of the genus *Cordyceps* are found in remote areas, therefore, at now for the production preparation on their basis is used

mycelium that gets by biotechnology. Nowadays interfacial (agar nutrient medium) are spread, submerged (by liquid media) and solid state (grain, sawdust substrate) the cultivation of these fungi.

On agarized environments fungi of the genus *Cordyceps* form a sufficiently wide range of enzymes, which are able to degrade the complex compounds the different origin. We conducted a qualitative color reaction in cultures of *C. sinensis 405* and *C. militaris 403* revealed the presence of enzymes of carbohydrate (amylase, cellulase, xylanase, glucosidase), nitrogen (protease, nitrate reductase, urease) and lipid (lipase) metabolism and redox processes (laccase, tyrosinase, peroxidase).

Given the biochemical characteristics of submerged *mycelium* of *C. sinensis* 405 and *C. militaris* 403. Total protein content was 21.2–22.5% and 14.3–15.4% in polysaccharides – 7,6–8,3%, lipids – 6,2–7,4%, total phenolic compounds, 950–1100 mg%, respectively.

Investigated the antioxidant activity of the extracts of fungi against antioxidants-ionol. High activity of different alcoholic extracts of *C. sinensis* – 78, 9–88, 6%. High enough antioxidant activity found in aqueous extracts (of 72.9–78.6%) of *C. militaris.*

The high antibacterial activity of the mixture of the culture fluid with a finely divided biomass strains of *C. sinensis.*

As a result of research it is established that the mycelium and culture liquid of fungi of the genus *Cordyceps* contain a complex of biologically active compounds carbohydrate, protein, lipid and phenolic nature. Further study of the fungi of the genus *Cordyceps* identify their features and properties that will enhance not only their scope, but also define alternative methods of cultivation with increase in productivity of production of biologically active substances.

Lutchenko V.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE ANALYSIS OF THE DYNAMICS OF THE INCIDENCE OF RESPIRATORY DISEASES OF THE POPULATION OF THE REPUBLIC OF BELARUS IN 2006-2014

The relevance of a problem of respiratory diseases is that they form very high levels of incidence, disability and mortality of the population, remaining at the same time potentially preventable. On their hum the risk of acute respiratory diseases more significantly increases in combination with which the threat of life to the chronic patient and to the elderly population.

Research objective is to carry out the analysis of dynamics of incidence of diseases of respiratory system of the population of Republic of Belarus in 2006–2014.

Object of a research is official statistical data on number of cases of respiratory organs diseases of the population of Republic of Belarus during 2006–2014, and statistical data on average annual population of Republic of Belarus.

The structural analysis of the common incidence showed that the main contribution to the structure of the common incidence of both the adult, and children's population of Republic of Belarus during 2006–2014 was brought by diseases of respiratory organs (19% – adults, 65% – children). The second rank place in structure of the common incidence was taken by blood circulation diseases at adults (42%) both some parasitic and infectious diseases at children (63%), the third – diseases of digestive organs (53% – adults, 75% – children) . Main contribution a contribution to structure of primary incidence of the population of Republic of Belarus of respiratory diseases at adults during 2006–2014 made respiratory illnesses. The first rank place in structure of the common incidence was taken by diseases of respiratory organs (35%). On the second rank place in structure of primary incidence occupied diseases of the digestive system (65%), the third diseases of osteomuscular and connecting fabric (45%).

The analysis of the dynamics has showed that primary incidence of the population of Republic of Belarus of respiratory disease from 2006 for 2014 fluctuated in slight limits. In 2006 the index of incidence made 40 thousand on 100 000 persons in 2009 it increased to 50 thousand by 100 000 people, further by 2014 decreased to 40 thousand on 100 000 persons. The average annual index of frequency of diseases made 42 133,73 on 100 000 people.

The common incidence of the population of Republic of Belarus of diseases of respiratory organs from 2006 for 2014 fluctuated in slight limits. In 2006 the index of incidence made 43 000 on 100 000 people, in 2009 it increased to 55 000 by 100 000 people, further by 2014 the persons decreased to 42 000 on the 100th. The average annual index of frequency of diseases made 131 951,89 on 100 people.

Analysis of regional characteristics showed that the overall incidence of respiratory diseases in the population of Minsk by 38.3% higher than the national average. The overall incidence of AML of the child population in Vitebsk (3,9%),Gomel (1.6%) and Minsk (3,5%) regions were on average level. The overall incidence of respiratory diseases of the child population of Grodno (-18,1%), Brest (–23,0%), and Mogilev (it is 21.4%) regions were below the national average.

The overall incidence of respiratory diseases in the adult population of Minsk 41.9% higher than the national average level. The overall incidence of respiratory diseases of the child population in Vitebsk (16,8%), Gomel (2.9%) and Minsk regions (2.0 percent) was the average national level. The overall incidence of respiratory diseases of the child population of Grodno (–28,4%), Brest (–31,0%) and Mogilev(–22,2%), regions were below the national level.

The overall incidence of respiratory diseases of the child population of Minsk 38.3% higher than the national average. The overall incidence of respiratory diseases of the child population in Vitebsk (3,9%), Gomel (1.6%) and Minsk (3,5%) re-

gions were on average level. The overall incidence of AML of the child population of Grodno (–18,1%), Brest (–23,0%), and Mogilev (it is 21.4%) regions were below the national average.

Ladyha A., Smolyakova R., Shpadaruk K.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

DIFFERENTIAL DIAGNOSIS OF LYMPHOMAS

Lymphoma is malignant tumors of lymphoid organs, that develop from lymphocytes, histiocytes and their precursors. This disease is a pathology which depends on the environment, because the incidence is increasing with deteriorating environmental conditions. Lymphoma is characterized by high aggressiveness of cells, high incidence and early metastasis. All malignant lymphomas are divided into two large groups, depending on the histological peculiarities, clinical implication and prognosis.

The first group includes a lymphogranulomatosis, or Hodgkin's lymphoma, or Hodgkin's Disease with cells such as multinucleated Reed–Sternberg cells. This group accounted for 25% of malignant lymphomas.

The second group includes non-Hodgkin's lymphomas which represent the majority of lymphomas.

Currently, a large number of methods of the disease diagnosis introduced into clinical practice. However, it is necessary to use a complex of methodical techniques for differential diagnosis to identify the disease at earlier stages.

There are comprehensive tests that are used in the differential diagnosis of lymphomas. It is medical history, physical examination and biopsy.

These tests include laboratory analysis, computed tomography, positron emission tomography, magnetic resonance imaging, pulmonary function tests, a bone marrow aspiration and biopsy.

In the first stage, lymphomas differential diagnosis includes determining the general physical status of the patient. First of all, it is a careful collection of medical history and clinical examination of the patient. Then a doctor conducts functional studies of the lungs, heart, liver, kidney, chest radiography in frontal and lateral projections, ultrasound of the abdominal cavity, retroperitoneal space and pelvis.

The next step at this stage is to identify comorbidities and collect general clinical and biochemical blood and urine tests. Then a doctor conducts the differential diagnosis of lymphadenopathy, cytological lymphoma verification, and indentifies extranodal lesions.

In the second stage, molecular biological studies are used to verify the morphological variant of lymphoma. They include immunohistochemistry, PCR diagnostics, sequencing, fluorescence in situ hybridization (FISH).

The stage of malignant lymphoma is determined in the third step, by beam diagnostics (by prescription), ultrasound, computed tomography and nuclear magnetic resonance.

Radionuclide studies methods liver, spleen, kidney, skeleton, bone marrow examination, and lumbar puncture also occur at this stage.

In the fourth stage, a definitive diagnosis is established.

Thus, it is necessary to carry out a combined functional and differential diagnostics of lymphoma for determining more accurate diagnosis of the early stages of the disease.

Makarevitch D., Gritsai N.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ANALYSIS OF THE INCIDENCE OF LARYNGEAL CANCER IN THE POPULATION OF THE REPUBLIC OF BELARUS FOR 2002–2013

Timeliness. Laryngeal cancer (LC) is from 2 to 5% of all malignancies annually diagnosed worldwide. The incidence of laryngeal cancer, compared with tumors of other localizations is relatively low. Over the past 10 years the number of new cases of Laryngeal cancer in Belarus remains almost unchanged. The disease usually occurs in the age groups of 40–60 years old, and men suffer from the disease 15–20 times more often than women.

Low rates of early active diagnosis of the cancer (55.9% in 2011), high rates of one-year mortality (25.3% in 2011) and the advanced malignant laryngeal tumors indicate the need for a systematic study of the major risk factors contributing to the LG on the territory of the Republic of Belarus.

The purpose is to analyze statistical data on morbidity of malignant tumors of the larynx among the population of Belarus and to identify the main trends in the incidence from 2002 to 2013.

The object of the study was the information on the number of laryngeal cancer cases in population of the Republic of Belarus for the period from 2009 to 2013, as well as the information about the number of inhabitants in the Republic of Belarus for the same period.

The analysis in the work showed that a decrease in laryngeal cancer specific gravity among the malignancies is observed. It can be also noted that LC incidence in urban population (4.5 per 100,000 people) is lower than in rural (7.5 per 100,000 people).

The analysis of the incidence dynamics by age groups showed that the increase in the morbidity of the male population occurs with age increasing and reach its maximum values for the people of 65–69 years old (52%). However, most women with laryngeal cancer account for the older age group – 70 years old (45.8%). From

the age of 75 years old there is a lower incidence of that cancer which may be caused by the difficulty in diagnostics at this age and higher probability of death.

Minimum incidence values are recorded in Minsk (3 per 100,000 people) and in Vitebsk region (3.7 per 100,000 people), the maximum values are in Minsk (4.9 per 100,000 people), Mogilev (4.8 per 100,000 people) Brest (5.0 per 100,000 people) regions.

In recent years, there is a positive tendency in increasing in LC diagnostics at early stages of its development.

The study of various issues related to risk factors of laryngeal cancer will improve the prevention programs and the impact on the level of this pathology.

Marchuk I., Shpadaruk E., Smolyakova R., Gritsai N.

Belarusian State University, Minsk, Republic of Belarus

MOLECULAR AND BIOLOGICAL BREAST CANCER

The steady growth of malignant diseases can be associated with the worsening of ecological situation in RB. Breast cancer is the most widespread oncological disease of women. This disease affects from 1:13 to 1:9 women aged from 13 up to 90 years old during the life and is a serious problem of health care around the world. About 1 million new cases are identified annually throughout the world.

Due to the progress in the sphere of molecular and genetic research, there is the increasing recognition of the comprehension of heterogeneity and pathogenetic variety of breast cancer (BC) .

In diagnostics and therapeutic approach to BC, the receptors of estrogen and progesterone are of the most importance. They represent specifically binding proteins which selectively influence a cell. At the same time, the lack of an expression of progesterone receptors is predicted to be an adverse factor for patients with BC. It is important to mention that co-expression with estrogen receptors is the characteristics of progesterone receptors. The presence of estrogen receptors in tumors is linked with a better prognosis in comparison with tumors which don't have these receptors.

The important diagnostic and prognostic factor is genotype.

Epidermal growth factor receptor of type 2 (HER2) is a transmembrane protein playing a key role in transferring the signals of growth factors. Hyperexpression of HER2/neu is an adverse prognosis for the course of a disease at BC associated with the prevalence of the neoplastic process.

Ki-67 is a nuclear anti-gene expressing in a proliferative phase of a cellular cycle. When Ki-67 is less than 15%, the tumor is considered to be less aggressive, and when an indicator is more than 30%, the tumor is considered to be highly aggressive and connected with the high risk of development.

P53 is the transcriptional factor regulating a cellular cycle and performing the function of a suppressor of formation of malignant tumors. At an increased

level of p53 expression in the patients with BC, the considerable reduction of survival index is noted.

PIK3CA plays the key role in regulation of the processes of growth, proliferation, differentiation, survival and metastatic activity of a tumor cell. PIK3CA mutation is defined in 23% of HER2 – positive BC and, as a rule, is associated with the poor response to treatment.

Now the majority of hereditary cases of BC is associated with BRCA1 and BRCA2 genes. The role of these genes is that they regulate the normal growth of cells and prevent possible cancer growth. Despite the presence of abnormalities or mutations in these genes, they promote the increased risk of BC.

Thus, the hormonal status and genotype have the essential meaning as a predictive factor and they are taken into account at hormonal therapy and chemotherapy.

Markevich M., Koktysh I., Gritsai N.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

OSTEOARTHRITIS BIOMARKERS

Osteoarthritis (OA) is a long-lasting chronic inflammation of the joints with their degenerative and dystrophic changes. In recent years the relationship between the induction of inflammatory and degenerative diseases of the joints with the effect of negative environmental factors (hypothermia and the effect of chemical toxins) or joint trauma has been widely discussed. In addition, such factors as age, genetic predisposition, gender, metabolic status and obesity contribute to the likelihood of developing the disease.

Hence, the timely diagnosis and prognosis of the disease on the basis of the identified biomarkers of the disease are of importance. Among the likely candidates associated with osteoarthritis are catabolic biomarkers (urinary C-terminal telopeptide of type II collagen and cartilage oligomeric matrix protein), post-genomic biomarkers and the MicroRNA.

Since type II collagen is the most abundant protein in cartilage, C-terminal telopeptide of type II collagen has become the widely accepted biomarker for assessing collagen breakdown. This component in cartilage degeneration may be released into blood, synovial fluid, and urine. The relationship between the concentration of C-terminal telopeptide of type II collagen and the prevalence and progression of osteoarthritis of the knee and hip joints is determined. It has been found that the patients with high levels of C-terminal telopeptide of type II collagen had the increased risk of having osteoarthritis of the knee and hip joints in comparison with the patients with its low level. Cartilage oligomeric matrix protein correlates with cartilage degradation and determines the severity level of the osteoarthritis. In addition to these biomarkers, hyaluronic acid is also included in the group of the catabolic biomarkers. Hyaluronic acid serum level is used as a biomarker to predict

osteoarthritis of the knee. This biomarker is highly specific and highly sensitive becuase hyaluronic acid is present in all connective tissues and tends to increase its level as a result of physical activity and food intake.

The group of post-genomic biomarkers includes transcriptomic biomarkers, proteomic biomarkers and metabolomic biomarkers. Transcriptomic analysis has been performed with the gene microarrays or RNA sequencing to quantify the abundance of all transcripts in a particular biological specimen. Gene microarrays are a powerful tool to identify the candidate RNA biomarkers for various pathological conditions including OA. Proteomic biomarkers clarify the information about the structure of the protein, provide the insight into the pathogenesis of the disease, and they are a powerful new tool for the study of biomarkers. Using liquid chromatography, scientists measured protein compositions in the cartilage of healthy patients and patients with osteoarthritis. Metabolomics is defined as the predominance of small molecular metabolites, which levels are determined as the final response of biological systems to environmental, genetic and other factors under normal conditions or in patients with the pathology. The ratio of serum metabolites such as valine to histidine and xleucine to histidine correlates with the severity of osteoarthritis of the knee.

MicroRNAs play an essential role in various physiological processes (cell proliferation, metabolism and apoptosis). Deregulation of microRNAs is associated with pathological conditions. It was found that during chondrogenesis, microRNA-140 upregulates its activity, but it is suppressed in chondrocytes at osteoarthritis. In serum, 3 microRNAs have been identified, which have predicted the risk of developing osteoarthritis of hip and knee joints.

Thus, the study of biomarkers can help to ensure the quality of improvement of the diagnosis, prognosis and understanding the pathogenesis of osteoarthritis.

Masliukova V., Shpadaruk K., Smolyakova R.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

MOLECULAR GENETIC RESEACH OF MELANOMA

Melanoma is the most aggressive malignant skin disease of the person with high risk of metastasis. It usually develops from melanocytes ─ the pigment cells which produce a specific polypeptide melanin. Melanoma is characterized by the accumulation of melanin in tumor cells although there are so-called pigment-free melanoma.

Scientists have recently identified a significant number of factors the influence of which statistically increases the risk of getting skin melanoma. The development of melanoma involves external environmental (ultraviolet radiation) and internal (genetic) factors.

The increasing incidence of melanoma observed in almost all countries of the world and for 40 years was about 5% per year. Currently, the treatment of melanoma has not been resolved, but the prospect in this direction may be associated with further study of the molecular and genetic processes of malignancy.

Risk factors of development of a family melanoma are germinal mutations in genes of cell cycle regulation CDKN2A and CDK4.

The CDKN2A gene is a cell division regulator. Mutations in this gene are the most common cause of inherited melanoma.

Violations of the CDK4 gene as well as violations of the CDKN2A gene can lead to an increased risk of getting skin melanoma. When CDK4 mutates, the enzyme becomes resistant to INK4A and functions as a heritable autosomal dominant oncogene increasing melanoma risk.

MITF regulates genes involved in proliferation (CDK2), differentiation, survival (BCL2, BCL2A1, ML-IAP, MET, APE1 and HIF1A) and the development of pigment. Expression of mutant MITF enhances the migration and invasive properties of melanoma cells that lead to an unfavorable course of the disease. MITF is a valuable diagnostic immunohistochemical marker for the detection of highly aggressive metastatic melanomas negative for other markers.

Signaling pathway RAS / RAF / MEK / ERK ─ a key regulator of cell proliferation, differentiation, survival and metastasis, hyper-activation which is observed in 75% of cases of melanoma.

If BRAF gene mutates, it begins to transmit the growth signal continuously, independently of external signals, leading to abnormal, uncontrolled division and reproduction of cells and hence to the emergence of malignant neoplasms.

Gene N-RAS is the second genome, the most frequent mutant form melanoma. NRAS protein is a regulator of the response to extracellular incentives, including growth factors, and activation of key signaling pathways. Most of the NRAS mutations lead to the formation of aberrant forms of protein, which cannot hydrolyze RAS-GTP and remains hyperactive.

C-kit-mutation of the melanocyte transplants leads to the uncontrolled proliferation of cells with high proliferative activity resulting in formation of highly aggressive forms of melanoma.

Thus, molecular genetic researches of melanoma in addition to post-mortem diagnostics can more accurately diagnose the type of melanoma, select individual tactics of treatment and predict the course of the disease.

Matusevich E., Yurkevich M.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

A TRYPAN BLUE ABSORBANCE ASSAY FOR DETERMINATION OF CELL VIABILITY

Cell viability may be judged by a variety of assays based on morphological changes, alterations in membrane permeability and/or physiological state (cytolysis or membrane leakage, mitochondrial activity, genomic and proteomic assays etc.). Dye exclusion methods are traditionally used to assess cell viability, with trypan blue being one of the most common. In trypan blue exclusion method, cell viability must be determined visually by counting the unstained/stained cells with a microscope.

In this work, we propose the determination of cell viability by trypan blue staining method with the following spectrophotometric detection.

Methods. Mononuclear cells isolated from heparinized peripheral blood of 10 healthy donors by ficoll-verografin gradient centrifugation (p = 1,077 g/cm^3, 30 min., 1500 rpm). The cell death was inducted by incubation of mononuclear cells with 0,05% solution of acetic acid (5 min., 37 °C). Cellular viability is determined by measuring the capacity of cells to exclude vital dye – trypan blue. Peripheral blood mononuclear cells (2×10^6/ml) were incubated with 0,2% solution of trypan blue (1:1) in buffered isotonic salt solution (pH 7,2 to 7,3). The cell viability was quantified in cell suspensions by a light microscope as well as in cell culture supernatants by spectrophotometer. The absorption was measured at 450 nm, the reabsorption – at 620 nm. The statistical analysis was carried out using Statistica 8.0. The statistical significance of the results was determined by Wilcoxon signed-rank test and Sperman`s rank coefficient correlation. The value are given as median (25÷75% procentile).

Results. The trypan blue exclusion test is based on the principle that live cells possess intact cell membranes that exclude certain dyes whereas dead cells do not. In view of this, viable cells had clear cytoplasm when observed under a microscope whereas a nonviable cell had a blue cytoplasm. The viability of nontreated cells was 80,0 (78,0÷86,0)% as well as the viability of acetic acid-treated cells was 47,0 (27,0÷50,0)% (p < 0,01). The intensity of cell culture supernatants absorbance at 450–570 nm was significantly lower in acetic acid-treated cells in comparison with untreated mononuclear cells (1,25 (0,75÷1,35) *vs.*1,43 (1,34÷1,45) a. u.). At that, the absorbance of 0,1% trypan blue clear solution was 1,51 (1,47÷1,54) a.u. The number of viable cells was positively correlated with intensity of cell supernatants absorbance (r_s = 0,88, p < 0,01). The mathematic model of cell viability calculation was based on the level of cell supernatants absorbance (X) and was as follows: [number of viable cells, %] = $203,57\times X_2 - 365,19\times X + 186,6$.

Conclusion. The spectrophotometric assay for determination of cell viability included mononuclear cells staining by 0,1% solution of trypan blue and measurement of cell supernatants absorbance at 450–620 nm.

Miller A., Malinovskaya Y.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

BREAST CANCER RISK FACTORS

Breast cancer is the most common malignancy among women and the second leading cause of mortality due to cancer worldwide. Rapidly increasing incidence of breast cancer is a new social challenge resulting from a spectrum of internal and external risk factors, which, although accepted as a feature of the early twenty-first century, are new for female sub-populations compared to the past. These include altered socio-economical conditions such as occupational exposure; rotating shift work; specific environmental factors (increased pollution and environmental toxicity, altered dietary habits, quality and composition of meals); as well as consequently shifted and/or adapted physiologic factors such as lower menarcheal age; late age of first full-term pregnancy, if any; shorter periods of breastfeeding; and later menopause.

The aim of this study was to evaluate the prevalence of internal and external risk factors in women diagnosed with breast cancer living in the territory of Minsk and the Minsk region. The subject of the study was a cohort of 100 women, between the ages of 21-55 years old, with a diagnosis of breast cancer. Age analyzing makes it possible to determine in which age group the highest incidence of breast cancer was observed. A survey method was chosen as the main method of study.

An electronic database was created through survey and analysis of medical records, and statistical analysis of the identified factors that make the greatest contribution to the genesis of breast cancer.

Looking at these results, we can conclude that the most widespread risk factors of breast cancer in the study group are: reduction of the lactation period, which was observed in 28 (73,68±7,14%) of 38 (45,78±5,46%) women who breastfed their children; the presence of abortions in anamnesis: induced abortions occurring in 35 (77,7±6,19%) of 45 (54,21±5,46%) women whose pregnancy ended in childbirth; and in 10 (22,2±6,19%) of 45 (54,21±5,46%) women whose pregnancy ended in miscarriage.

In conclusion, the creation of individual patient profiles and regulation of modifiable risk factors may be the most optimal predictive and preventive strategy.

Mishura A.[1], Rymko A.[2], Kvach S.[2], Zinchenko A.[1, 2]

[1]Institute of Microbiology of the National Academy of Siense of Belarus, Minsk, Republic of Belarus;

[2]International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

CONSTRUCTION OF STRAINS, PRODUCING RECOMBINANT DEOXYNUCLEOSIDE KINASE, CONTAINING IN THEIR SRTUCTURE CHITIN-BINDING DOMAIN

Enzyme immobilization technology is one of the key modern industrial biotechnologies. This technology is used to improve the enzyme catalytic functions such as activity, stability, and selectivity, it can be used repeatedly and continuously, which significantly reduces the cost of the process.

The commonly employed techniques for immobilization of enzymes are – chemical, physical and affine binding.

Chemical immobilization is based on formation of covalent bonds between matrix and enzyme. It makes impossible to desorb enzyme, but leads to multiple modification enzymes and, as a consequence, to change their properties and inactivation. Physical method of immobilization is based on adsorption without formation of covalent bonds, leading to enzymes desorption during enzymatic reactions. Affine method saves enzyme activity unchanged and provides reliable bonding with surface of the carrier.

Among the many affine carriers must highlight the chitin – one of the most common biopolymer, which have chemical resistance, a well-defined pore structure and low cost.

The literature describes chitin-binding domain (ChBD) of *Bacillus circulans* chitinase A1 (ChiA1). The properties of ChiA1 defines the robust and affinity bonds with the substrate.

In connection with the above, the aim of this work was the creation of strains of chimeric proteins containing in their structure ChBD of chitinase A1 *B. circulans.*

Using polymerase chain reaction method gene ChBD was isolated from A1 chitinase *B. circulans* and inserted with 5'- and 3'-ends of the target gene in plasmid pET42dnkDm. As a result, two new constructs were obtained: pET42dnkDm_ChBD (N) and pET42dnkDm_ChBD (C). These constructs were used to transform cells *Escherichia coli* BL21 (DE3).

Thus obtained two strains producing *deoxynucleoside kinase* (*E. coli* pdnkDm_ChBD (N) and *E. coli* pdnkDm_ChBD (C)) having ChBD at N- and C-ends.

It was *established* that a strain of *E. coli* pdnkDm_ChBD(N) produces the target protein in 5 times more than strain *E. coli* pdnkDm_ ChBD (C). D*eoxynucleoside kinase* amount in cell lysates was about 50 and 10% of total cellular protein in strains *E. coli* pdnkDm_ChBD (N) and *E. coli* pdnkDm_ChBD (C), respectively.

The results will be used in further research on the immobilization of proteins and heterogeneous biotechnological synthesis.

Moduleva E., Shpadaruk E., Smolyakova R., Gritsai N.
Belarusian State University, Minsk, Republic of Belarus

MOLECULAR-BIOLOGICAL MARKERS OF COLORECTAL CANCER

The issue of the day of modern oncology and proctology is colorectal cancer (CRC), the increase of its morbidity is related to a great extent to worsening of ecological situation in the Republic of Belarus. 99% of colorectal cancers are well-known as adenocarcinomas, and nowadays the development of colonic adenocarcinomas is considered to be the well studied model of oncogenesis.

At the present time, the research of features of tumor biological behavior is one of the most crucial in oncology. The findings of structural and functional changes of oncogenes and genes-suppressors in the process of the tumor development and progression were the cause of the basis of the determination of clinically significant molecular factors .

A colorectal cancer is a multifactorial disease depending both on genetic and exogenous factors.

In the last few years of rapid development of molecular biology, it was found out that the genes possessing the ability to control the process of the disease development are of great significance.

So, the mutations of AIP gene (adenomatous intestinal polyps) are associated both with the inherited and sporadic cases of colorectal cancer. Gene damages result in the unlimited division of tumor cells and, as a result, lead to the increased distribution of the tumour process.

K – ras is a gene playing an important role in a receptor signaling system of the epidermal growth factor (EGFR). This gene damaging leads to the decline in the CRC patient's survival rate.

P53 is an albumen preventing the division of potentially tumorigenic cells. However, the insufficient functioning of this albumen makes a cellular division possible even at DNA damages. Its hyperexpression results in an unfavorable prognosis of the course of the disease and the early relapses.

DCC is a supressor gene, and its albumen is a surface glycoprotein, which is responsible for the processes of cellular adhesion. The decline in the expression of DCC gene results in the dispersion of tumor cells, and the prevalence of tumor process finally increases.

Also, a diagnostically important marker for determination a proliferative activity is the nuclear albumen Ki – 67. Its hyperexpression allows distinguishing tumor cells being in the active phase of a cellular cycle.

Thus, molecular-biological markers help to diagnose a colorectal cancer at earlier stages, to define the degree of tumor aggressiveness and to forecast the course of the disease. As a result, the hyperexpression of Ki – 67, p53, DCC, mutated APC and K – ras genes signal about the unfavorable course of the disease.

Moroz L.[1], Cherkovskaya A.[1], Talako T.[2]

[1] International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;

[2]Belarusian Medical State University, Minsk, Republic of Belarus

APPLICATION OF BOTH SPECIFIC AND NONSPECIFIC IMMUNOLOGICAL PARAMETERS IN ASSESSMENT OF RHEUMATOID ARTHRITIS

Rheumatoid arthritis (RA) is a complex systemic autoimmune disease with unknown etiology characterized by chronic erosive arthritis and systemic inflammatory manifestation. Progression of disease in Ra is associated with high-level production of inducible proteins such as pro-inflammatory cytokines (interleukin (IL)-6, TNF-α, IL-1β, IL-4), antibodies (rheumatoid factor (RF), antibodies to cyclic citrullinated peptide (antibodies to CCP) and acute-phase proteins (C-reaction protein (CRP)). Division of the patients, suffering from RA, to seropositive and seronegative groups according to detection of RF also influences clinical laboratory indexes.

The purpose of the work was to identify the diagnostic value of specific and nonspecific immunological parameters of patients with RA with a high level of disease activity, identified by DAS28 score. The objects of the study were 20 patients with a positive diagnosis of RA and high level of clinical activity in 80% cases (DAS28 > 5,1). All the patients were hospitalized in Rheumatology department of "Clinical Hospital 9" in Minsk. Immunoassay methods were used to measure the level of IL-6, TNF-α in peripheral blood (serum samples), latex-tests were used to determine the level of the RF and CRP, the chemiluminescent microparticle immunoassay was applied to determine the level of antibodies to citrullinated proteins (anti-cyclic citrullinated peptide/anti-CCP antibodies). Erythrocyte sedimentation rate (ESR) was also measured and used in panel of tests to detect of disease activity.

Our results demonstrated significant increase the levels of RF (30[4; 14] U/ml, p = 0.01), CRP (80[3,5;30] mg/l, p = 0.01), IL-6 (23,69 [9,4; 53,2] pg/ml, p = 0.01) in comparison with healthy subjects (RF– don't identified, CRP – 1,2 [0.4;6.8] mg/l, IL-6 – 1,61 [0.45; 2.6] pg/ml). All the RF-seropositive patients demonstrated increased level of CRP in peripheral blood. There was the increase in the rate of ESR in 11 out of 20 patients with median value of 17,5 [6,5;46] mm/h in comparison to 7 [3;12] mm/h in healthy subjects. Mean level of the anti-

bodies to CCP in peripheral blood of patients with RA was 116,4±19,2 U / ml compared to 2,2±0.44 U / ml in subjects of healthy control group.

In conclusion, persistence of the high level of IL-6, CRP, RF, antibodies to CCP in peripheral blood of most of patient with RA is a valuable marker of inflammation to characterize disease activity that is closely related to summarized clinical DAS28 scoring.

Moyurnikava A., Porada N.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

CAUSES OF CHILD MORTALITY IN THE REPUBLIC OF BELARUS

Problem Statement. Children mortality rates are indicative of the health status of the population. Evaluation of children mortality causes enables to detect the most severe forms of diseases playing a significant part in the child mortality structure thus facilitating the targeted disease control.

Objective: to study structure and dynamics of child mortality according to the causes during the period from 2005 to 2014 and to detect the age peculiarities.

Study subjects and methods: The formal statistic data on mortality rates of the child population in the age of 0–17 as well as on infant mortality were analyzed. The following methods were used: relation coefficient calculation, relative number error calculation with the aim to detect statistical significance, calculation of the longstanding tendency according to the first-order parable and evaluation of statistical significance.

Results and discussion. During the period from 2004 to 2014 the structure of child mortality causes remained fairly stable. Dominated were the accidents, injuries and intoxication accounting for more than 30%. Certain conditions originating in the perinatal period were the second most frequent causes – 19.14%, followed by the birth defects – 17%. Nervous system disorders accounted for about 8.5%, tumor growths constituted 6.1%; infectious diseases – 4.8%. Generally, mortality of the child population during this period was characterized by the definite downward trend – the trend index constituted 2.53 per 100 thd. children ($R^2 = 0.93$) due to decrease of child mortality indexes from external causes by a factor of 2.1 ($A_0 = 17.73^0/_{0000}$, annual trend index $A_1 = -1.36^0/_{0000}$, $R^2 = 0.91$) and birth defects by a factor of 1.5 ($A_0 = 9.12^0/_{0000}$, $A_1 = -0.49^0/_{0000}$, $R^2 = 0.79$). Average annual rate of child mortality caused by the nervous system diseases was at the level of $4.34^0/_{0000}$, child mortality from malignant tumors averaged to $3.26\%_{000}$, and from infectious diseases – $2.21^0/_{0000}$. Analysis performed did not detect consistent tendencies in the child mortality dynamics from these causes. Generally, child mortality rates during the period studied decreased by a factor of 1.5: from 64.3 per 100 thd. children in 2005 to 43.7 in 2014.

One of the most important component of child mortality is infant mortality. In several years, the infant mortality rate exceeded 50%. Generally, during the period studied the infant mortality decreased from $641.4^{0}/_{0000}$ in 2005 to $345.6^{0}/_{0000}$ in 2014 or by a factor of 1.9. The main reasons of infant mortality were certain conditions originating in the perinatal period and birth defects. Their aggregated proportion constituted 64.86%. 8.9% cases of infant mortality were caused by the accidents, 6.4% – by infectious diseases, respiratory diseases and nervous system diseases accounted for 5.8% and 4.4% correspondingly.

Conclusion. During the period studied child mortality in the Republic of Belarus decreased by a factor of 1.5, including the infant mortality that decreased by a factor of 1.9. This tendency points to effectiveness of medical assistance provided for children and adolescents and life quality improvement of the population in general.

Murina K., Lemiasheuski V., Klimovich O.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE ROLE OF ESTABLISHING THE MAXIMUM ADMISSIBLE CONCENTRATION OF MEDICINAL SUBSTANCES AT PHARMACEUTICAL ENTERPRISES

With the growth of drug production volume, hygienists and occupational therapists are getting into the following tasks :

1. Severization of quality requirements applied in industrial environment at chemico-pharmaceutical enterprises;

2. Implementation of hygiene standards to ensure healthy and safe working conditions at the production of potentially dangerous chemicals and compounds.

Specifics of drug production is largely determined by its preproducts and end products. Preproducts are substances obtained at particular production stages. End products are medicinal drugs by itself.

In the working area concentrations of these compounds may exceed the permitted levels. It is especially true for operations related to loss of containment, loading and unloading of bulk solids, technological sample selection.

Inhalational penetration of toxicants is of greater danger, as most of the air cells surface is actively washed by blood, which facilitates rapid absorption of toxicants and their conveying to the vital centers. Consequently, in the chemical and pharmaceutical industry the most common occupational diseases are:

- rinolarongofarengit (a disease of the mucous membranes of the nose, throat, larynx),
- erosion (ulcer) and perforation of the nasal septum,
- tracheitis,

- bronchitis,
- pulmonary fibrosis (degeneration of lung tissue).

Due to technological, economic and some other difficulties, it is not possible to completely eliminate adverse factors from the production environment. Introduction of maximum permissible concentration (MPC) would limit the adverse effects chemical compounds make on human and prevent occupational diseases. The chemicals that cause adverse health effect may be present in the working area in the form of gases, aerosols and vapor mixture.

Established MPC are concentrations, which effect cannot cause diseases or abnormalities in health status detected by modern methods of research; it concerns not only the entire length of service, but also the late periods of life of present and future generations.

Justification for MPC level and other preventive measures requires the following information to be obtained:

1. Substance production and use condition;
2. Data on the chemical structure, physical and chemical properties;
3. Substance toxicity and its impact after a single exposure on the body;
4. Substance cumulative capacity after repeated exposure on the body;
5. Study of local irritant and skin-resorptive effects of substance;
6. Threshold of harmful effect while chronic substance admission into the body.

Thus, compliance with hygiene standards will provide health safety of workers with no risk.

Nabokov A., Ruta-Zhukovskaya E., Bokut S.

National Anti-Doping Laboratory, Lesnoy, Republic of Belarus;
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

MASS SPECTROMETRY ANALYSIS OF MINOR GLYCOHEMOGLOBIN A_{1C}

Minor form of human hemoglobin A_{1C} is a product of post-translational modification of hemoglobin A_1 glucose by α-β chains, as well as ε-amino groups of amino acid side chains. This modification can be considered as a marker protein of one of the most serious diseases, which over the years has grown into an epidemic, namely diabetes. Currently HbA_{1C} is used as a common indicator to assess the condition and the degree of compensation of carbohydrate metabolism as it allows to track blood glucose levels over a wide time range.

Despite the fact that HbA_{1C} is used as a protein marker of diabetes, this minor form of itself is an important object of study. For example, it is shown that carbohydrate modification HbA_1 alters its ability to bind allosteric effectors, and has a significant impact on the transportation function. As shown HbA_{1C} that can partic-

ipate in the effective generation of active oxygen species capable of initiating oxidative stress in patients with diabetes.

Studies of structural and functional behavior of the carbohydrate modified hemoglobin A_{1C} is directly dependent on its availability for the study, and therefore the development of effective methods of isolation and purification.

The basic method that allows you to select HbA_{1C} for analytical purposes, and in preparative amounts, and at the same time, preserving the native allocated HbA_{1C} is an ion-exchange column chromatography. As the ion exchange resin to separate hemoglobin A_{1C} widely used Bio-Rex 70 cation exchange resin

For receiving Hemoglobin A_{1C} in Preparative column number on ion exchange resin Bio-Rex 70 hemoglobin A_1 drug was applied, which was pre-incubated in a glucose solution. As a result, HbA_{1C} was obtained in preparative amounts, suggesting the possibility of using Bio-Rex 70 for isolation, purification and subsequent study of this modification.

Purity the selected HbA_{1C} was confirmed by proteomics «top-down» with the use of chromatography-mass spectrometry of high resolution. Deconvolution analysis of the mass spectra of the chromatographic separation of hemoglobin A_{1C} under denaturing conditions showed the presence of only the β-subunits modified glucose (Figure 1).

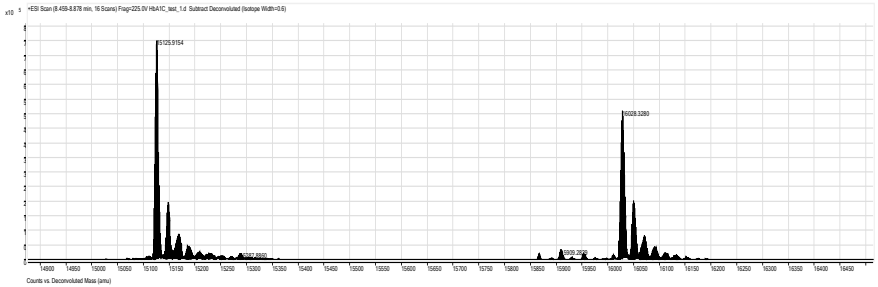


Figure 1. – Results deconvolution of the mass spectrum of the peak glycosylated hemoglobin HbA_{1C} minor forms at its chromatographic separation under denaturing conditions

Navitskaya T., Lemiasheuski V.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

LASER THERAPY IN THE TREATMENT OF DIABETES MELLITUS TYPE II AND ITS COMPLICATIONS

The problem of diabetes mellitus (DM) is extremely challenging all over the world on account of constantly growing prevalence proportion taking the form of a pandemic disease.

The number of DM patients in 2015 amounted to 415 million people worldwide, prevalence proportion of the disease among the population – 9 %, but at the same time only 50 % of DM cases were diagnosed. In the Republic of Belarus as at 01.01.2016 the number of DM patients in the follow-up care amounted to 287 976, including 17 026 DM type I patients, 268 092 DM type II patients, 407 gestational DM patients, and 1 798 patients with other specific types of diabetes. 27 084 people were newly diagnosed with diabetes in 2015 (a 6–10 % increase per year over the last 5 years). In general structure the prevalence proportion of DM type II accounts for 93 % in Belarus.

The primary DM incidence at the beginning of 2016 totally amounted to 305.13 per 100 thousand population, including DM type I – 8.52; DM type II – 285.24. Total DM incidence rate amounted to 3 030.3 per 100 thousand population.

DM type II is caused by ineffective insulin usage by the human body. This type of disease is more widespread and that to a large extent results from an excessive weight and physical inactivity. The symptoms of DM type II may be similar to DM type I, but often these symptoms are less expressed. The main complications of this disease are damage to kidney, blood vessels and eyesight, nervous system disturbance. Abovementioned complications may lead to disability, therefore the search for new ways of treatment and reduction of complications threat level are relevant objectives at the moment. In this regard the top-priority is the choice of treatment which has a many-sided effect on the human body. One of these methods is the low-level laser therapy (LLLT).

Low intensity laser therapy is referred to electromagnetic radiation of optical range. The helium-neon laser radiation has a low radiant power – up to 20 mW with a wavelength equal to 630 nm capable of affecting trigger mechanisms of cellular regulation, changing cell membrane condition by the increase of cells functional activity, changing of metabolic processes, stimulating of microcirculation and oxidation-reduction processes, as well as increasing the human body tolerance. At the same time laser radiation has not so many contraindications, which include ideosyncrasy, febricity, presence of benign or malignant tumors.

Currently there is no consensus on laser impact on the human body, its separate systems and abnormal focus. It is assumed that the variability and systematic nature of secondary biochemical and physiological effects of LLLT on blood is explained by the variety of photoacceptors and primary photobiological reactions implemented on different levels. Laser interaction with a biological object includes the following stages: light quantum absorption and intramolecular energy redistribution (photophysical processes), an intermolecular energy transfer and primary photochemical reactions, biochemical processes involving photoproducts, secondary photobiological reactions and the body's general physiological response to the effect of light.

As a result there is a set of issues to be analyzed: required method of LLLT effect on the human body in case of DM, time of the human body exposure to radiation required for emergence of the therapeutic effect, treatment course duration.

Pavlovich A., Malinovskaya Y.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE GENES PREDISPOSING BREAST CANCER AMONG RESIDENTS OF THE GOMEL REGION

In the last decades the breast cancer (BC) reserves the status of one of the main reasons for death from malignant neoplasms which risk of development is enlarged and infringes on interests almost everyone. Among the factors defining development of BC, a specific place is held by genetic predisposition. One of appreciable achievements in the field of studying of genetic predisposition to BC was opening of genes of *BRCA1* and *BRCA2* (*BRCA1.2*), which mutations explain a high risk of emergence of BC.

Mutations of a gene of *BRCA1* define up to 87% of risk of development of BC aged up to 70 years and 50% aged up to 50 years, and *BRCA2*– gene mutation to 35% of lifelong risk of development of BC. Emergence of mutations happens owing to influence or external factors (smoking, radiation, alcohol), or internal (hormones, immune system). Causal factors can work in common or serially, causing or activating a carcinogenesis.

Allocation of the genes responsible for genetic predisposition to BC framed essentially new opportunities of medico genetic consultation and prophylaxis at the same time of a disease. DNA diagnostics of mutations in genes of *BRCA1.2* provide objective criterion for formation of the BC risk groups for the purpose of its prophylaxis and well-timed diagnostics in case of developing of a disease.

The purpose of our research inhabitants of the Gomel region had a studying of frequency of occurrence of mutations of genes of *BRCA1.2.* The group of a research included women with the diagnosed BC aged from 25 up to 50 years.

For identification of mutations on genes of *BRCA1.2* the heteroduplex version of the PCR analysis was used. The heteroduplex analysis allows to identify the mutations, which are in a heterozygous state. Existence in a two-chained fragment of DNA of not coupled bases changes confirmation of such heteroduplex that is shown in change of electrophoretic mobility of a fragment when carrying out gel electrophoresis, and allows to identify a mutant component.

We studied 5 main mutations of genes of *BRCA1* (185delAG, 5382insC, 2274insA, 4153delA) and *BRCA2* (6174delT).

The molecular and genetic analysis which is carried out by us in selection of 100 sick BC living in the Gomel region taped 5 cases of mutations of genes of *BRCA1,2*. Frequency of occurrence of mutations of a gene of *BRCA1* made

4±1,9%; the most widespread is the mutation 5382insC which share made 75% of all taped mutations. The mutation 4153delA meets in an isolated case and makes 25%. Mutations 185delAG and 2274insA, in the studied selection are absent. Mutation frequency 6174delT in a gene of *BRCA2* made 1% in the studied selection.

Thus, the generative mutations defining hereditary risk of development of BC are mainly bound to *BRCA1* gene, and the most often meeting mutation – 5382insC.

Petryakova E., Supranovich D., Ablekovskaya O.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

MICROCIRCULATORY CHANGES IN THE OVARY OF THE FETUS OF WHITE RATS UNDER THE INFLUENCE OF RADIATION FACTOR IN EMBRYOGENESIS

Allocation of critical periods is due to the difference in the sensitivity of cells, their high mitotic activity, changing conditions of existence of different individual sensitivity of the organism and its tissues and organs.

An important role to play in this regard, blood capillaries, responsible for the blood supply to organs and tissues, providing a normal and organo- histogenesis. They also determine the viability bodies in the definitive body, providing the necessary level of trophism their specific working structures. It is now recognized that virtually none of the disease is not without involvement in the pathological process of different parts of the capillary bed. The most radiosensitive of all mammalian reproductive systems considered.

The data of researchers, which describes the changes in the structure and function of sex glands at relatively low doses compared to other organ systems.

Radioresistance of the organism depends on the dose rate, exposure time, the value of absorbed dose. Small doses can also provide not only negative, but positive effect, which is called radiation hormesis.

Experimental animals were exposed to single acute exposure of gamma rays at a dose of 0.5 Gy on the 10th day and the 14th day of prenatal development.

During the data were obtained , indicating that the changes in the blood capillaries associated with the state of their transport processes, synthetic processes, energy processes, as well as with changes in the minimum diameter, cross-sectional area of the cytoplasm of endothelial cells. It should be noted that the degree of these changes are more pronounced after irradiation on day 14 of prenatal development.

We can conclude, relying on data from our studies that the degree and nature of the effects on morphological and functional parameters of blood capillaries (diameter, the sectional area of the lumen, wall thickness) and the value for the developing in this period bodies is large.

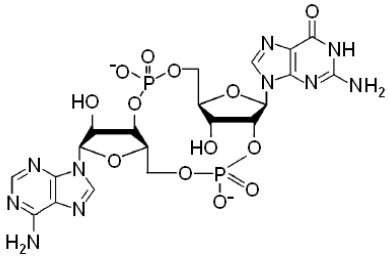
As a result of the degradation processes we observe inhibition of transport systems blood capillaries, synthetic systems and resize themselves capillaries, which negatively displayed on their activities. It should be noted that in addition to violations of the synthetic processes are disrupted and energy production processes, which are responsible for mitochondria.

Pryhozhaya D., Bokut S., Surint T.

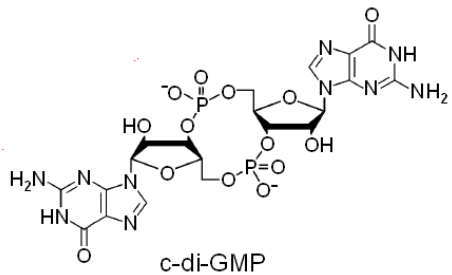
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

IMMUNOMODULATORY ACTIVITY OF CYCLIC DIMERIC PURINE NUCLEOSIDEMONOPHOSPHATES

Cyclic dimeric purine nucleosidemonophosphate are low-molecular compounds of nucleic nature, which take part in the regulation of many intracellular processes in bacterial cells and eukaryotic cells. In particular, the appearance of double-stranded alien DNA in the cytoplasm of mammalian cells serves as the "danger signal", which results in the binding of this DNA with synthetase of cyclic dimeric GMP-AMP (cGAS). Activated cGAS catalyzes the formation of secondary messenger c[G (2',5') pA (3',5')p] with unusual 2',5'-bond, which initiates the subsequent activation of the synthesis route of type I interferons (type I IFN) . Despite the high immunostimulatory activity of c[G(2′,5′)pA(3′,5′)p] its practical application is complicated largely due to low availability. On the other hand, cyclic dimeric guanosine monophosphate (c-di-GMP), which has a bacterial origin, is also able to influence eukaryotic cells as a "danger signal" and express significant immunomodulating adjuvant activity against various bacterial infections, including the ability to influence the production of IFN I type cells of the immune system.



2′,3′-cGAMP



c-di-GMP

Induction of gene expression of IFN type I is a key event in the initiation of anti-infective immune response. IFN type I modulate the maturation of dendritic cells and their cooperation with lymphocytes, the activation of the expression of costimulatory molecules and cytokine secretion. Moreover, the transmission of signal from IFN I type involving transcriptional activator STAT1 at the same time stimulates gene expression of IFN II type (IFNγ), which takes part in the regulation of innate

and acquired immunity mechanisms, cell cycle, apoptosis, and inflammatory response by the control of transcription of a wide range of genes.

Low availability of c[G(2′,5′)pA(3′,5′)p] for a comprehensive study of immunomodulatory properties with the purpose of its practical application, simultaneous similarity of this cyclic dimeric purine nucleosidemonophosphate structure with c-di-GMP, which also influences eukaryotic cells as a "danger signal" and has a significant immunomodulatory activity, allows primarily to consider c-di-GMP as a perspective basis for creating a highly efficient immunomodulating agent.

Rusak A., Pyrko A.

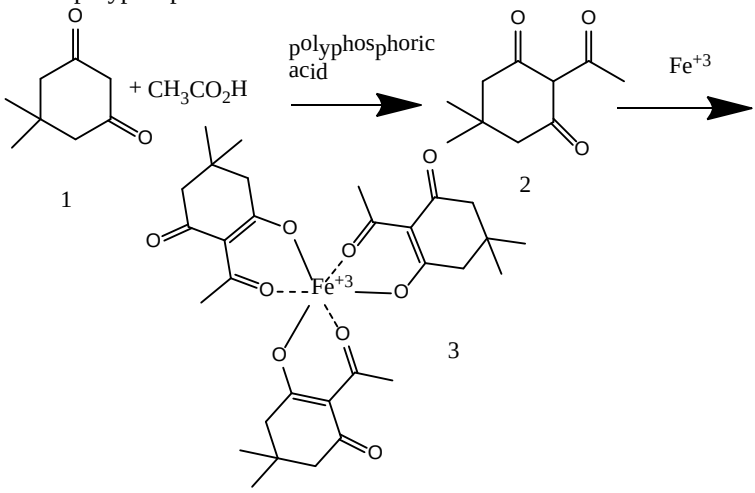
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

SYNTHESIS AND USING OF 2-ACETYL-5,5-DIMETHYLCYCLOHEXANE-1,3-DIONE AS COMPLEXOMETRIC TITRATION INDICATOR

In analytical chemistry, complexometric indicators are used in complexometric titration to indicate the end point of a titration.

Here in we wish to report our results on synthesis of 2-acetyl-5,5-dimethylcyclohexane-1,3-dione (2) and the possibility of using this compound as indicator of complexometric titration of solutions containing Fe^{+3} cations. This substance is bidentate ligand and it forms a chelate compounds with metal cations. Thus it forms iron (III) red colored octahedral complex (3) and hence may be used as an indicator for determination of iron by chelatometry method.

The substance investigated was obtained by heating dimedone (1) with glacial acetic acid in polyphosphoric acid.



Prepared 0.02 molar ferric chloride solution was titrated with a solution of EDTA using as an indicator known (sulfosalicylic acid) and the resulting triketone (2). Titration results were the same. Thus, it was shown that the obtained compound can be used as an indicator in determining the concentration of iron (III) by complexometric method. It was used as alcohol solution.

Rybachenok D., Puhteeva I.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

IMPACT OF PURINE NUCLEOTIDES ON A CONDITION OF SYSTEMS OF CYCLIC NUCLEOTIDES IN CELLS OF IMMUNE SYSTEM

Cyclic nucleotides are universal regulators of biochemical processes in living cells. A leading role of a cyclic nucleotide in a cell is phosphorylation of proteins of ribosomes which are catalyzed by protein kinases. This in turn influences character and amount of synthesizable proteins in a cell. The research of impact of purine nucleotides on a human body will help understand processes of normal functioning more detailed, violation of purine exchange and influence of purines on a set of the reactions happening at the cell-like level. The purpose of work is to analyze possible changes of concentration of cyclic nucleotides in cells of the immune system of rats at influence of purine nucleotides. The object of the research were thymus cells (thymocytes) and lymphocytes of peripheral blood of rats. The maintenance of intracellular cAMF and cGMP was defined by a radio immune method by means of reference sets (IBOH NAN RB). It is showed that purine nucleotides in different degrees affect the system of cyclic nucleotides in thymocytes and lymphocytes of peripheral blood. So, exogenous ATP authentically increased the maintenance of cAMF and cGMP in thymocytes, and the system of cyclic nucleotides in lymphocytes of peripheral blood showed pronounced changes at action of an adenosine. Mounted effect of increasing the content of cyclic nucleotides adding purine nucleotides can be explained by the fact that ATP and adenosine act on the corresponding receptors: Adenosine activates P1 - purinoreceptors (A1- receptor), which have a high affinity for adenosine and ATP and its analogs stimulate structural P2 - purinoreceptors. From the obtained data it is possible to draw a conclusion that purine nucleotides in different degree affect system of cyclic nucleotides in thymocytes and lymphocytes of peripheral blood. Exogenous ATP authentically increases the maintenance of tsAMF and CGMP in thymocytes, and the system of cyclic nucleotides in lymphocytes of peripheral blood showed pronounced changes at action of an adenosine.

Ryzhkova V.[1], Nasonova E.[2], Kutsalo P.[2]

[1] International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;

[2]Joint Institute for Nuclear Research, Dubna, Russia

CHROMOSOME ANALYSIS FOR CALIBRATION CURVE CREATION FOR POTENTIAL RETROSPECTIVE DOSE ESTIMATION

Biological dosimetry (biodosimetry) is the investigation of radiation-induced biological effects called biomarkers, in order to correlate them with radiation dose. The main biological markers, or biomarkers, used are chromosome aberrations. Biodosimetry is an important technique for many reasons. It can provide invaluable information for clinicians dealing with patients who have received high doses of radiation (>1 Gy acute), allowing them to plan appropriate therapies and determine possible health consequences that may arise. It is also useful for cases where the dose is below the threshold for immediate treatment, as it can guide the counselling of irradiated patients in the risks of developing cancers and other late stochastic diseases in the future.

Estimating the frequency of chromosomal aberrations in the peripheral blood lymphocytes of the exposed person is considered the gold standard of biodosimetry by the IAEA (International Atomic Energy Agency). Close correlations between the number of lymphocytic chromosomal aberrations in peripheral blood lymphocytes and radiation dose have been demonstrated in a number of studies involving animals and humans, both in vitro, and in vivo. Calibration curves are used to convert a patient's aberrations score to a figure representing their absorbed dose. Computer software which creates calibration curves has been designed, due to the fact that the creation of calibration curves is typically a lengthy process; involving complicated algorithms and the need for dose uncertainty calculations. This software enables faster data point plotting and simplifies the process of calculating confidence intervals for the dose response curves generated. For exposure to low LET radiation, the most widely used software packages to fit dose calibration curves are CABAS (Chromosomal Aberration Calculation Software) and Dose Estimate. CABAS employs the maximum likelihood (ML) statistical method, whereas Dose Estimate is based on the iteratively reweighted least squares (IRLS) method.

The aim of this study was to establish calibration curves illustrating unstable chromosomal aberrations caused by ionizing radiation, through the study of the cytogenetic effects ionizing radiation has on human blood lymphocytes in vitro. Whole blood samples were irradiated in vitro, with doses of radiation equaling 0.5, 1, 2 and 3 Gy with Co^{60} γ-rays of the radiation therapy unit ROKUS-M (JINR, Dubna, Russia). The number of dicentric chromosomes, centric and acentric rings and acentric fragments seen during the first postirradiation mitosis were then recorded in the lymphocytes after 48 h of culture, and CABAS software was used to

create a calibration curve in the dose range of 0.5 to 3 Gy. It was found that the number of unstable chromosomal aberrations seen in the lymphocytes was dependent upon the dose of ionizing radiation they received, and that this relationship could be described by a linear-quadratic function. The frequencies of dicentric and centric rings as markers of the radiation action were slightly different for different donors, this can be explained by differing individual radiosensitivity.

Sadovskaya M., Batyan A.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

DEFINITION OF THE METHEMOGLOBIN AFTER LASER RADIATION

Studying of the mechanisms which are the cornerstone of biochemical processes of violation of kislorodtransportny function of blood is an urgent problem of modern biology and medicine.

Especially particularly important this problem became in Republic of Belarus where in the considerable territory presence of high level as the radionuclides and nitroconnections promoting as to an inherited disorder natural the metgemoglobinreduktaznykh of systems, and leading to an excess metgemoglobinoobrazovaniye is noted.

The purpose of work was determination of content of a methemoglobin in peripheral blood of healthy people after laser radiation.

The methemoglobin represents the connection which is formed of hemoglobin by iron atom oxidation from bivalent to a trivalent state. In blood of the healthy person the maintenance of a methemoglobin does not exceed 2% that is reached by balance between reactions of its education and reactions of restoration of a methemoglobin. The most significant of them it is reaction under the influence of NADFN-zavisimoy MetHb-reductases with formation of the oxidized NADF+ and reaction under the influence of NADN-zavisimoy MetHb-reductases with formation of the oxidized NAD+, and also non-enzymatic reaction of formation of degidroaskorbinovy acid from ascorbic acid. If the maintenance of a methemoglobin in blood exceeds 2% – it is called a metgemoglobinemiya.

As a result of the researches conducted by us it was established that the content of oxyhemoglobin after radiation in samples of blood is more, than the maintenance of a methemoglobin after radiation. Then the percentage ratio of a methemoglobin in blood of people was calculated. As showed results of researches, the maintenance of a methemoglobin in erythrocytes of healthy people after radiation is in limits of $\geq$10,3%. In this work reliability of distinctions between the compared sizes was considered reliable at $p \leq 0,05$.

One of the main links in a chain of metabolic violations of system of transport of oxygen blood – reaction of transformation of hemoglobin in its inactive form –

a methemoglobin. In this regard there is a need of search of methods and means of correction of such damages increasing efficiency of oxidation-reduction processes of restoration of a methemoglobin.

Scherbina E.[1], Batyan A.[1], Kireikov A.[2]

[1] International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;
[2]Republic Research Unitary Enterprise «Bel RC «Ecology», Minsk, Republic of Belarus

MEDICAL WASTE. THE GROWING ISSUES OF MANAGEMENT AND DISPOSAL IN THE REPUBLIC OF BELARUS

Large amounts of expired and unused medications accumulate in households. This potentially exposes the public to hazards due to uncontrolled use of medications. Most of the expired or unused medications that accumulate in households (household medical waste) is thrown to the garbage or flushed down to the sewage, potentially contaminating waste-water, water resources and even drinking water. There is evidence that pharmaceutical active ingredients reach the environment, including food, however the risk to public health from low level exposure to pharmaceuticals in the environment is currently unknown. In Belarus, there is no legislation regarding household medical waste collection and disposal.

On the other hand, there is a problem with the handling of medical waste at the national level. In the Republic of Belarus, a system dealing with pharmaceutical products with an expired shelf life and highly toxic drugs has not yet been conceived (cytostatistics). According to state statistics in 2015 the Republic of Belarus formed 8.98 tons of pharmaceutical waste (expired medicines, pharmaceutical preparations, which have become unusable, residues) and 46.5 tons of cytostatic pharmaceuticals (expired, became unusable; residues).

From the 8.98 t of pharmaceutical waste formed at the beginning of the year (1.79 t in 2014) 2.88 t was used; 1.24 t was neutralized; 4.50 t was buried in landfills; and the remaining 0.57 t was used for storage on site organizations where it was formed; meaning the presence of waste at the end of the year amounted to 2.15 t with regard to cytotoxic drugs, formed from 46.5 t in relation to the waste at the beginning of the year of waste (94.86 t in 2014) 5.95 t was used, 63.27 t was neutralized; 4.0 t was used for storage on site organizations where it was formed; the presence of waste amounted to 72.13 t at the end of the year.

The main problem - handling of cytotoxic pharmaceutical products - waste first hazard class, which are formed on the basis of many medical institutions. Cytotoxic agents - medications that are widely and successfully used in the treatment of cancer. The result is toxic waste, particularly at temperatures above 20 degrees. They can easily penetrate into the human body through the lungs, gradually affecting the hematopoietic, reproductive and immune systems. The requirements of sanitary

norms and regulations for cytostatic waste pharmaceuticals has provided a method of neutralization by pyrolytic incineration at temperatures below 1200^0 C. In our country furnaces with similar temperature conditions are only used by a few companies involved in the production process and are not intended for incineration cytostatics. In accordance with the provisions of normative legal acts in the absence of pharmaceutical hazardous cytotoxic waste (PHCW) technologies for cytostatic waste pharmaceutical destruction must be kept in special rooms, in order for drug agencies to be allowed to use them. Only some hazardous waste is sent to the furnace. One option for a temporary solution to the problem of accumulated waste (PHCW) is depositing it on the CUE "Complex on processing and landfilling of toxic and industrial waste of Gomel Region."

Thus, at the national level, the issue of the utilization of PHCW can be resolved by the organization: temporary storage of PHCW on the territory of the unitary enterprise « Complex on processing and landfilling of toxic and industrial waste of Gomel Region " and burning at a temperature not lower than 1200^0 C in special installations, which requires the purchase of special equipment.

Resolution of this issue requires a significant financial investments and the participation of all interested bodies of state administration, as well as executive and administrative authorities.

Scherbina E.[1], Matyash M.[1], Batyan A.[1], Puhteeva I.[1], Gustova M.[2], Kamanina I.[3], Puhaeva N.[3], Chegoeva D.[3]

[1] International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;
[2]Joint Institute for Nuclear Research, Dubna, Russia;
[3]State University «Dubna», Dubna, Russia

X-RAY FLUORESCENCE ANALYSIS OF LEAD-ZINC WASTES

X-Ray Fluorescence analysis (XRF) is a nondestructive physical method used for chemical elemental analysis of materials in the solid or liquid state. The specimen is irradiated by photons or charged particles of sufficient energy to cause its elements to emit (fluoresce) their characteristic x-ray line spectra. The detection system makes determining energies of the emission lines and their intensities possible. Elements in a specimen are identified by their spectral line energies or wavelengths for qualitative analysis, and intensities are related to concentrations of elements, providing an opportunity for quantitative analysis.

XRF provides one of the simplest, most accurate and most economic analytical methods for the determination of the chemical composition of many types of materials. It is non-destructive and reliable; requires little to no sample preparation; and is suitable for solid, liquid and powdered samples. It can be used for the determination of a wide range of elements, from potassium to uranium, and provides detection limits at the ppm level; it can also measure concentrations of up to 100% easily

and simultaneously. Heavy and toxic elements can be identified in environmental samples (geological and ecological, plants, herbs, soil, etc.) using XRF. 26 elements like K, Ca, Ti, Cr, V, Mn, Fe, Ni, Cu, Zn, As, Se, Br, Rb, Sr, Y, Zr, Nb, Mo, Ag, Sn, Sb, Cs, Ba, La, Pb can be determined simultaneously in a sample. Detection limits for the different elements are between 1 and 5 mkg/g, depending on the matrix and Z of the element. Relative errors between 1 and 10% are typical for trace element analysis. A certain advantage of this method is the relatively simple sample preparation procedure.

The main task of our study was to investigate the main principles of XRFA; to prepare samples for analysis and XRF-spectrometer measurement; construct ~~a~~ calibration curves for the Cd-109 source, considering matrix effects; and realize the qualitative and quantitative analysis of samples.

Multi-elemental analysis of the samples was carried out at the Flerov Laboratory of Nuclear Reactions (JINR, Dubna, Russia). The experimental material used in this study was received from Unal tailing, located in North Osetia-Alania. This study was conducted in collaboration with State University "Dubna" and GUP "Basis stock" (North Osetia-Alania).

The samples were analyzed by an X-ray fluorescence spectrometer with Si (Li) detector (area 30 mm^2 surface, 3 mm thickness, Be window thickness 25 um, full width at half maximum (FWHM) resolution – 145 eV at 5.9 keV energy).

Standard ring-shaped radioisotope sources Cd-109 (E = 22,16 keV, T1/2 = 453 days) and Am-241 (Eg = 59.6 keV, T1/2 = 432.2 years) were used for the excitation of X-ray radiation.

The united standard curve was used for analysis. The calibration curves for analyzed samples calculated resulted in the measurement of 10 reference samples (soil-5, SP-3, ENO and etc.).

As a result of our work the full qualitative and quantitative contents of real samples were estimated. In some samples the content of certain elements exceeds the MPC: Mn, Ni, Cu, Zn, As, Cd, Sb and Pb.

Also, some samples were rich in sulfur, likely existing in a sulfide form. This can prevent the migration of heavy elements to other areas due to its insolubility.

Semak A., Snytkov E., Gritsai N.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ACE GENE POLYMORPHISM CONTRIBUTION TO THE DEVELOPMENT OF ONCOLOGICAL PATHOLOGIES

From the viewpoint of biology, tumor transformation is the result of the gradual accumulation of genetic alterations in cells affecting different cellular regulatory mechanisms. ACE gene is a key enzyme of the renin-angeotenzin system, which is involved in the regulation of blood pressure, the number of erythrocytes in the

blood, and cardiovascular homeostasis. It was also demonstrated that ACE gene, in addition to the production of angiotensin II, is an activator of bradykinin. Bradykinin is known to be established as a factor of tumor formation due to its ability to stimulate the growth of vascular permeability.

In fact , the genes required for certain functions such as vascular alteration are known to be probably involved in primary tumor progression and metastasis. Cancer cells may disseminate early enough in relation to the period of tumor existence in the body. Angiotensin-converting enzyme is a key enzyme in the RAS and can affect the tissue angiogenesis, cell proliferation, apoptosis, and inflammation. The results of epidemiological and experimental research have shown that the RAS can contribute to paracrine regulation growth of tumor. During the studies it was found out that renin levels increased in patients with hepatic cirrhosis and hepatocellular carcinoma. ACE gene overexpression was noted in extrahepatic cholangiocarcinoma in myeloid leukemic blast cells and in macrophages of the lymph nodes in patients with Hodgkin's disease.

While the work was being performed, we collected and in analyzed the statistical data showing that the ACE gene single nucleotide polymorphism may have a significant impact on the risk of oncological pathology, in particular breast cancer. I / D-polymorphism of ACE gene was associated with a 3-year disease-free survival. Disease free survival for D / D carriers was significantly reduced compared with the I / D and I / I carriers. There is the evidence that RAS inhibitors reduce the tumor growth, progression and metastasis. Angiogenesis, cell growth and invasion of cancer cells have been the targets for new strategies for the treatment of malignant tumors in recent years.

Based on the initial data, we can summarize the following:

1. Genotyping results allow to conclude that I / D ACE gene polymorphism results in an increase of breast cancer and other forms of cancer risk of oncologic pathology.

2. People with D / D genotype of high activity are marked by an increased risk of breast cancer compared to people of II / ID genotype of low activity.

3. RAS inhibitors result in the reduced growth and angiogenesis in tumor cell lines.

Semenchikova K., Gritsai N.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

QUANTITATIVE CHARACTERISTICS OF T LYMPHOCYTES IN PATIENTS WITH MULTIPLE SCLEROSIS

Multiple sclerosis (MS) is the central nervous system demyelinating disease characterized by multifocal white matter lesions and chronic paroxysmal-progressive course. The pathogenesis of MS involves an immune attack against the

central nervous system antigens, mediated through the activation of $CD4^+$ myelin-reactive T-cells with the possible contribution of B-cells. The immunopathogenesis of MS associated with the disturbed self-tolerance to other antigens and myelin, the central nervous system results in activated peripheral autoreactive T-cells.

The objective is to study the quantitative characteristics of T lymphocytes in patients with multiple sclerosis.

The tasks are the following:

1. To assess the number of different T lymphocyte subpopulations in patients with MS.

2. To compare the parameters of T-cell immunity in patients with MS and the experimental group.

3. To evaluate and compare the number of subpopulations of T-lymphocytes in patients with different forms of MS course.

The research methods. The number of T-lymphocytes of peripheral blood was determined by flow cytofluorometry.

The results:

1. In patients with multiple sclerosis, the changes in cellular immunity characterized by lymphopenia with a statistically significant reduction in relative value of $CD3^+$T-lymphocytes and γδT lymphocytes in the peripheral blood are revealed. This indicates the possible involvement of γδT lymphocytes in the development and regulation of the specific immune process as cytotoxic, regulatory T cells and antigen-presenting cells.

2. The most pronounced changes in the number of T-lymphocytes are determined in secondary-progredient course of the disease when degenerative processes prevail over the autoimmune reactions. The marked reduction in $CD3^+$ lymphocytes in combination with a statistically significant increase in the subpopulation of T lymphocytes-helpers may indicate an enhancement of humoral immune responses mediated by the production of antibodies by B-lymphocytes to myelin antigens, which enhances the manifestation of destructive processes in the central nervous system.

Conclusions. Considering the leading role of immunological reactions in the pathogenesis of multiple sclerosis, immunological monitoring for the activity and development of the pathological process of this disease is of great importance. On the basis of the data of long-term studies of the immunity in patients with multiple sclerosis it can be said that, firstly, immunological changes are ahead of the clinical ones; secondly, immunopathological process is dynamic, and in the course of the disease the reaction of the immune system changes, the depletion of a number of compensatory reactions occurs, and a number of new protective reactions simultaneously develop.

Shavalda E., Melik-Kasumov T., Batyan A., Subbota E.
Belarusian State University, Minsk, Republic of Belarus

PESTICIDE POISONING AS A FACTOR OF SEIZURE AND EPILEPSY DEVELOPMENT

Epilepsy is one of the most frequent human chronic neurological pathology accompanied by recurrent seizures. ILAE defines an epileptic seizure as “a transient occurrence of signs and/or symptoms due to abnormal excessive or synchronous neuronal activity in the brain”. Such abnormal neurone activity without the proper treatment can lead to cognitive deterioration and motor disabilities, neurodegeneration of brain tissues and even to death.

Today among the etiological factors nerve tissue malformations, encephalomas, craniocerebral injuries, blood-strokes, metabolic disorder complications, drug abuse, infections, hereditary factors are noted. Also exposure to toxins has a considerable impact on formation of epileptic focus or on brain activity increase.

Among the main groups of toxins, which are able to cause epileptic fits, we can highlight pesticides, chemical warfare agents, industrial chemicals, plant and animal toxins. What concerns the development of seizures and epilepsy**,** the particular interest is acute and chronic pesticide poisoning.

Such pesticides as thiophos, sevin, chlorpyrifos can inhibit an enzyme called acetyl cholinesterase. Their actions lead to hyperstimulation of cholinergic synapse in brain. Hyperstimulation of postsynaptic muscarine acetylcholine receptor causes increased glutamate exudation. Surexcitation of its receptors leads to neuropathological changes, which cause epileptiform activity in formed focus.

A focus can be formed in different centres of brain: cerebral cortex, hippocampus, thalamus and amygdala. Other pesticides, such as DDT, permethrin, fenvalerate are able to increase the activity of potentially dependent natrium channels, that increases neutron excitability. Such pesticides during poisoning can increase seizure activity of the brain and lead to convulsive seizure in healthy individuals. Entering the nervous tissue, pesticides of group 3 such as aacyclo, endosulfane, strychnine slow down inhibitory facilities. It leads to disinhibition of many neuron chains, that causes epileptic fit.

So, many pesticides which are used today can lead either to the formation of single seizures or to epilepsy due to chronic poisoning. Taking into considerarion the active processes of neurogenesis in young brain, such poisonings are dangerous especially for children.

Shutsikava L., Puhteeva I., Gerasimovich N.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

MODERN TRENDS IN THE DEVELOPMENT OF RADIATION PROTECTION

The need of the present time is the study and development of new tools for radiation protects therapy effective in conditions of prolonged exposure to low dose, because lately an increasing number of individuals in contact with sources of ionizing radiation. Radiation protective drugs used mainly for personal protection against external irradiation in emergencies (emergency, military terms) and for superior protection of normal tissues in radiotherapy of malignant tumors.

Currently, as a promising direction in this area deals with multifunctional tools, the effect of which is aimed at the protection and treatment of the effects of radiation. So it has been shown that cell-based products multipotential mesenchymal stromal cells imposed locally or systemically have a therapeutic effect on organs and tissues irradiated.

On the other hand actively explores the radiation protective properties of inorganic (salts of selenic acid) and organic compounds of selenium. Experiments have shown that the optimal time of prophylactic inorganic compounds of Selenium is 24 h before irradiation. There has been an increase in the survival rate of fatally irradiated animals on 20-40%. The best effect is marked with the introduction of gypsum sodium (5.0 mg/kg) and manganese gypsum (10.0 mg/kg). Prophylactic use of organic selenium compounds also improves the course and outcome of acute radiation injury. The best results are obtained with the introduction of selenium tetracisteinum (STC). The results suggest the prospect of further targeted search bio amongst organic compounds of selenium.

Currently, radiation protect is also considered the effectiveness of various synthetic drugs on indicators of stimulation system of glutathione and reduction of severity of lipid peroxidation. It was show that the original tissue antioxidant status makes a different contribution to the manifestation of radiation protect properties of natural and synthetic antioxidants due to the nonlinearity of the lipid peroxidation processes depending on the dose of radiation and its power.

Thus, the collection of experimental data demonstrates the need for an integrated approach to the assessment of the effectiveness of different drugs and radiation protect accounting temporary factors when used as radiation protectors in radiation lesions of different severity.

Sinenok D., Zinchenko A.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

IMMUNOSTIMULATION AS ONE OF WAYS OF USING MICROORGANISMS IN MEDICINE

The antigenic load on the population of the Republic of Belarus and the whole world is constantly increasing. Particularly acute, this problem became more severe due to the deterioration of health of the population after the rapid industrial growth and the reduction in the ecological quality of the environment.

Currently, this problem is becoming increasingly important due to the fact that one of the main means to combat bacterial pathogens – antibiotics – rapidly reduces its effectiveness. Bacterial agents mutate rapidly, thereby acquiring resistance to most modern antibiotics. In connection with the above-described facts relevant learning and discovering new ways to combat bacterial pathogens are beyond doubt.

This issue is also important because the level of immune protection of the population in a number of generations is gradually decreasing due to the negative environmental impact. One of the most rapidly developing and promising directions in this field is immunostimulation. It allows you to improve the human immune system and thereby contribute to its opposition to the antigenic load.

One of these tools is a specialized plasmid of American company «ColeyPharmaceuticalGroup» (CpG) Synthetic product oligodeoxynucleotide containins unmethylated motifs of the CpG, which act as a powerful immune stimulant and can be used to improve the body's immune response.

The purpose of work is to draw the attention of young scientists to one of the possible ways to solve the problem of inefficiency of modern medicine, as well as a demonstration of the possibilities of using the microorganisms ability to obtain drugs without the need of complex and financially costly multi-step chemical syntheses.

Skrechko K., Shpadaruk K., Smolyakova R.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

IMMUNOPHENOTYPIC FEATURES OF B-CELL NON-HODGKIN'S LYMPHOMS

Nowadays medical research in the field of B-cell non-Hodgkin's lymphoms develops in a rapid pace.

The occurrence of this type of lymphomas is often associated with changes in the environment. Lymphomas are detected mostly in agricultural workers, people who are in contact with pesticides, various fertilizers, solvents.

The research of the immunophenotypic and morphologic features of B-cell non-Hodgkin's lymphomas is a key issue, because it is the basis of the diagnosis and prognosis of this disease.

Non-Hodgkin's lymphomas are group of histologically and biologically heterogeneous malignant tumors of the lymphoid system. B-cell lymphoproliferative tumors are characterized by uncontrolled production of B-lymphocytes cell structures, which are normally engaged in immune activity.

The immunophenotyping is based on the analysis of specific protein markers on the surface of the lymphocytes or inside them. They are called clusters of differentiation and are denoted by index abbreviated as “CD” with their identification numbers.

Among all of the peripheral non-Hodgkin's malignant lymphomas the most common is diffuse large B-cell lymphoma. The disease is characterized by high aggressive and dynamic growth, without an adequate treatment the metastatic lesion of an organism can lead to death. Diffuse large B-cell lymphoma includes: primary mediastinal large B-cell lymphoma, T-cell/histiocyte rich large B cell lymphoma, anaplastic lymphoma kinase-positive diffuse large B-cell lymphoma.

Primary mediastinal large B-cell lymphoma is 6-10% of the total number of diffuse lymphomas, one of the most aggressive types of large b-cell lymphoma and it is characterized by rapid growth. Pathological cells express CD19, CD20, CD79a antigens. The CD5 and CD10 antigens expression isn’t observed. The expression of CD30 is marked in many cases. Tumor cells express common leukocyte CD45 antigen, CD23 antigen, which is rarely found in other variants of diffuse lymphomas.

T-cell/histiocyte rich large B-cell lymphoma has an aggressive course and is often diagnosed at a common stage with involving cancer of the bone marrow. Pathological cells express CD45 and B-cell differentiation markers CD20, CD79a and PAX-5. In most cells there is lack of expression of CD10, CD15 and CD30. There is also expression of mature T cells markers – CD2, CD3, CD5 and CD7; most of them are CD8+. Different number of CD68+-reactive histiocytes has been identified.

Anaplastic lymphoma kinase- positive diffuse large B-cell lymphoma is characterized by the formation of large tumor clusters, which according to their macro - and microscopic characteristics resemble carcinoma or melanoma. ALK does not have B- and T-cell markers, do not express CD30 and CD45. Cells express cytoplasmic granular type ALK and CD138antigens of cells plasma. Malignant cells may express cytoplasmic IgA (rarely IgG), CD4, CD43 and CD57.

Five-year survival in cases of large-cell lymphoma is 85% now for the early stages, but only 26% for the last stage. The main aspect of these indicators is the timely diagnosis of the disease. Research in this field is the most important, because

treatment and the further prognosis of the patient's life depends on the quality of diagnostics directly.

Tarun E., Duduk V.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ANTIOXIDANT PROPERTIES OF CITRUS FRUITS JUICE

High concentration of free radicals in the body is one of the major risk factors of developing cardiovascular and oncological diseases and other pathological conditions. Flavonoids are powerful antioxidants which can be used in the prevention of various diseases. Naringin and hesperidin are one of the most common flavonoids that can be found in citrus fruits. These flavonoids display the unique ability to increase elasticity and capacity of blood vessels. Thus, these flavonoids can be employed in the prevention of cardiovascular diseases. These flavonoids also enhance the work of the liver and produce anti-inflammatory effect. Hesperidin is contained in oranges, tangerines, lemons and limes. Moreover, lemons and limes contain eriocitrin which is similar to hesperidin in its structure and properties. Naringin can be found in grapefruits. All of these flavonoids have similar structure – they have a glycoside that can enhance their antioxidant properties because of additional OH-groups. We used freshly squeezed orange, tangerine, grapefruit, lemon and lime juices to analyse the antioxidant properties (AP) of these flavonoids. Moreover, we also compared the properties of freshly squeezed orange and grapefruit juices with that of packaged orange and grapefruit juices from different manufacturers.

The method of the AP detection in relation to reactive oxygen species (ROS) is based on the measurement of the oxidized compound fluorescence intensity and its reduction due to ROS. We used fluorescein which is a compound with high extinction coefficient and fluorescence quantum efficiency close to 1 for the detection of free radicals. Free radicals were generated using the Fenton system with hydroxyl radicals generated in the reaction of Fe2+ complexes with ethylenediaminetetraacetic acid (EDTA) and hydrogen peroxide.

The relationship between fluorescence intensity of fluorescein and juice concentration logarithm was analysed for each sample with juice concentration of 0.01–10%. Orange juice exhibited the highest antioxidant activity; its fluorescence recovery was 78% with 2% juice concentration. AP of grapefruit juice and tangerine juice were somewhat lower: ROS activity was reduced to 61% and 52% respectively. Fluorescence recovery for lemon and lime juices was 44–45% with 0.2% juice concentration. Packaged orange juice and grapefruit juice had the lowest AP in comparison with freshly squeezed juice with fluorescence recovery of 47–56%. IP50 values (juice concentration with 50% of free radical inhibition) were presented in graphic form.

According to their free radicals scavenging properties, citrus fruits may be arranged in the following order: orange > grapefruit > tangerine > lemon > lime with IC50 of 0.073–0.73% which demonstrates high antioxidant properties of the citrus juices analysed.

Telyak A., Chertogova I., Lozinskaya O.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE USE OF CYTOLOGICAL INDICES OF ALLIUM CEPA AS TEST OBJECTS IN ANTHROPOGENICALLY DISTURBED AREAS

The ever-growing degradation of the natural environment under the influence of anthropogenic pollution poses a threat to the survival of mankind. As a rule, almost any man-made phenomena and processes occurring within the immediate impact of industrial production, quickly affect the condition of ecosystems as a whole. Modern technical means of control of environmental conditions, designed primarily to assess the extent of contamination in the industrial environment are not the only ways to determine the state of the natural environment.

The soil is actively involved in many important processes of transformation of substances. Among numerous soil pollutants, heavy metals make a significant contribution to environmental pollution. As a result of research of many scientists in recent years to study the impact of heavy metals on plants and animals. Meanwhile, the toxic effect of heavy metals on plants is manifested, as a rule, when a high level of technogenic pollution of soils and depends on the properties and behaviors of a specific metal.

Bioindication is the best and actively developing method of its evaluation. It involves the observation of natural and anthropogenic processes in biological environments, including the totality of the interaction of the living with agents of the external environment, including the elucidation of responses of biological media on natural and anthropogenic influences. Biological methods help to diagnose negative changes in the environment at low concentrations.

In bioindicators can be plants, animals, protozoa. Vegetation is the main component of biogeocenosis, which provides the livelihoods of other biotic components. Vegetation changes under the influence of various environmental factors affect the condition of ecosystems in General and therefore are used as diagnostic features. In the study we used a widely encountered bioindicator – Allium cepa. In contemporary studies of Allium cepa L. the reference plant is considered a test object for analysis of the mutagenicity of mitotoxicity and toxicity of various factors. Allium test is recommended by who experts as the standard in the cytogenetic monitoring of the environment. The results obtained using this test correlate well with tests on other organisms: plants, insects, mammals.

The purpose of the study was to examine the state of soil cover of urban areas with high anthropogenic load (on the example of Gomel) using plant test systems.

For the study used aqueous extract of the soil, the breed of Gomel. Was used the method of Allium-test. Were taken into account indicators such as mitotic index, germination energy, the frequency of common aberrations (lagging chromosomes, ahead of a chromosome, chromosomal bridge).

In the experiment, it was shown that combination of chemical elements contained in water extracts inhibited the growth of roots, reduce mitotic index of meristem cells and contribute to the occurrence of chromosomal damage.

Tokarchuk E., Koktysh I.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

IMMUNOFLUORESCENCE AS A METHOD OF ENVIRONMENTAL IMPACT ASSESSMENT ON CELL STRUCTURE

Recent advances in fluorescence microscopy allow us to estimate the impact of environmental factors on the molecular level. The opportunity to study different types of cells allows detecting the disorders caused by environmental factors. Impact harmful environmental factors such as radiation can cause malignant tumors in various organs and tissues. Using fluorescence helps in the investigation of the molecular mechanisms of occurrence and development of pathological processes, the effects on the body of biologically active substances.

Currently widely used type of fluorescence is immunofluorescence. Immunofluorescence is a technique used for light microscopy with a fluorescence microscope. This technique uses the specificity of antibodies to their antigen to target fluorescent dyes to specific biomolecule targets within a cell, and therefore allows visualization of the distribution of the target molecule through the sample. It is used fluorescent dyes as a markers of monoclonal antibodies (FITC (Fluorescein isothiocyanate), TRITC (Tetramethylrhodamine-5-(and 6)-isothiocyanate), Cyanines (Cy2, Cy3, Cy5 and Cy7), Alexa Fluor).

In fluorescence microscopy not only proteins structures are of interest but also nucleic acids, lipids and etc. DAPI (4',6-diamidino-2-phenylindole) as DNA stains and family of Hoechst dyes are capable to make a difference between DNA and RNA without previous manipulation is Acridine Orange. MitoTracker is used as a cell permeable dye with a mildly thiol-reactive chloromethyl moiety for observation of mitochondria. For staining of the endoplasmic reticulum (ER) are used DiOC6(3) or ER-Trackers. ER-Tracker Green and Red are BODIPY (borondipyrromethene) based dyes which are linked to glibenclamide – a sulfonylurease – which binds to ATP sensitive potassium channels exclusively resident in the ER membrane. Recently it is possible to stain special membrane regions like lipid-rafts.

These cholesterol rich domains can be visualized by using NBD-6 Cholestrol or NBP-12 Cholesterol amongst others (Avanti Polar Lipids).

Fluorescent Speckle Microscopy images of actin and microtubules in the lamellae of living epithelial cells were able to observe microtubules and the binding of microvesicles to the membrane (labeled with X-rhodamine tubulin). The spatial and temporary resolution in immunofluorescence is used for studying of dynamics of actin and the actin connected proteins near a plasma membrane in many researches of an endocytosis. Taxol conjugates are used for endpoint assays of cytoskeletal behavior in live cells to provide intense staining of polymerized tubulin. Also, immunofluorescence is applied to track the movement of individual vesicles and exocytosis, which turned out to be a bit more complicated than previously thought. With the help of this method investigate the transmission of signals through the membrane. Immunofluorescence method is also used to study the dynamics of adhesion molecules. It is possible to localize specific DNA sequences in chromosomes or determine spatial-temporal characteristics of gene expression in cells or tissues.

Due to the wide range immunofluorescence dyes, high-affinity monoclonal antibodies used for the immunohistochemical analysis, there appeared the possibility of identifying pathological changes in cells more efficiently.

Vadadokhau U., Henova A.

National Anti-doping Laboratory, Lesnoy, Republic of Belarus;
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ANALYSIS OF RECOMBINANT HUMAN ERYTHROPOIETIN BY LIQUID CHROMATOGRAPHY-MASS SPECTROMETRY

Erythropoietin is a glycoprotein hormone that stimulates erythropoiesis through controlling the proliferation and differentiation of the erythroid progenitors. EPO carries out the most important biological functions, concerning it was the first cloned factor of hemogenesis. Human recombinant erythropoietin rhEPO is widely used to treat different types of anemia. Also, it is well-known as a drug enhancing endurance in athletes. In this connection, erythropoietin was banned in some sports by WADA since 1989.

Thus, great importance is development of a method to differentiate between endogenous and exogenous EPO origin. This is due to the fact that about 40% of human erythropoietin molecule weight is compiled by oligosaccharide chains attached to the polypeptide in three N-glycosylation sites (Asn 24, 38 and 83) and one O-glycosylation site (Ser 126). Composition and structure of oligosaccharides chains play critical role in biological activity of EPO. While polypeptide chain is genetically controlled, oligosaccharides chains are result of post-translational modifications which differ in various species and tissues.

In this study the methodological approach of recombinant human erythropoietin detection by high resolution mass spectrometry based on their prior tryptic hydrolysis ("bottom-up method") was developed. Peptides obtained from tryptic hydrolysis was separated by HPLC method on reversed-phase column and analyzed using high resolution mass spectrometer Agilent 6550 iFunnel Q-TOF. Designed approach allowed to detect all non-glycosylated rhEPO peptides (figure 1). Compound and structure of found peptides were proved by tandem mass spectrometry.

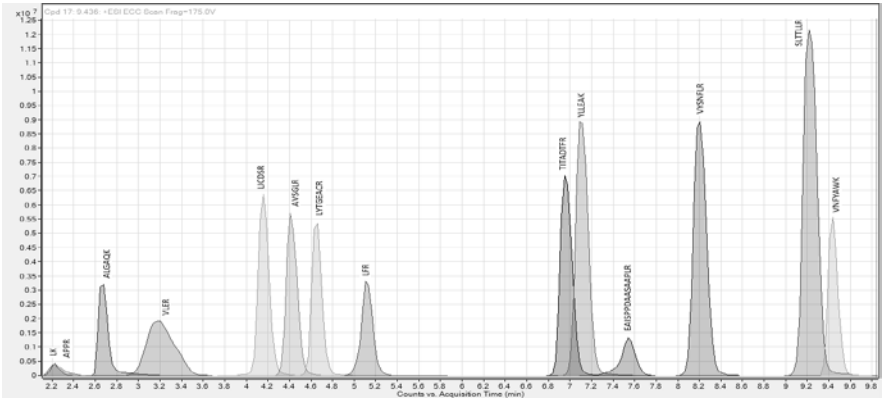


Figure 1. – Chromatogram of peptide mapping of recombinant human erythropoietin (tryptic digestion)

Simultaneously, chromatography – mass spectrometry allowed to identify wide range of mixture compounds which were determined as various types of glycopeptides. It is caused by heterogeneity of oligosaccharide components in erythropoietin. Utilization of LC-MS method in conjunction with computer modeling makes it possible to assume oligosaccharide chains structure of present glycopeptides.

Videvich V., Malinovskaya Y.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

CYTOLOGIC FEATURES BREAST CANCER AFTER RADIOTHERAPY

Breast cancer occupies the first place in the structure of oncological diseases of the female population, its rate is rising, especially among the elderly. Mortality from breast cancer remains high, despite the progress in treatment and improving the quality of the diagnosis of this pathology.

Criteria for cytological diagnosis of malignant tumors based primarily on cell morphology and especially nucleus, and the presence of abnormalities in chromo-

some sets, increasing the cell cycle time compared to the normal formation of micronucleus, nuclear protrusions and various pathologies of mitosis.

During the cytological and cytogenetic analysis, the object of the study was smears of tumor breast tissue among women aged 44 to 65 years with invasive breast cancer after radiotherapy.

In the course of our study normal and abnormal mitosis were found. The frequency of cells in mitosis was 0,092±0,027%, cell distribution of the phases of mitosis normally was: 91.3% prophase, telophase 8.7%. Cells at the stage of the metaphase and anaphase were not detected. In the result of smears analysis we identified the following types of abnormal mitosis: c-mitosis (mitosis colchicine), lagging chromosomes in metaphase, anaphase bridges and another mitosis. Among pathological mitosis, anaphase bridges were the most frequent 0,121±0,003%. The frequency of mitosis was 0,014±0,003%, lagging chromosomes in metaphase was 0,007±0,003%, the share of other mitotic was 0,05±0,007%. Along with internuclear chromatin bridges, which are continuously joining the nuclei were seen to explode bridges – "caudate nucleus". The smears were found with multiple nuclei "tails": two (0,057±0,021%), three or more (0,007±0,007%). The greatest number of cells amounted to a "tails" (0,564±0,066%). In this study, we counted the cells with one, two, three or more micronuclei. The total number of cells with micronuclei was 4,592±0,183%. The frequency of cells with a micronuclei was 3,908±0,170%, with two – 0,431±0,057%, and three or more micronuclei – 0,255±0,044%. Total found micronuclei – 5,531±0,201%. It should be noted that cells with two, three or more micronuclei, as a rule, are more common after radiation exposure. We have also taken into consideration the frequency of cells with nuclear protrusions. Analysis of nuclear protrusions in cells of invasive breast cancer showed great variety and high frequency of their occurrence in tumor cells. Cells were detected with a nuclear protrusion (0,836±0,08%), two – (0,043±0,018%), three or more – (0,014±0,01%).

Yakubchik N., Dudinskaya R.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

QUANTITATIVE ANALYSIS INDICATORS OF CHILD MORBIDITY IN BARANOVICHI

Relevance. Today's children are the main reproductive group of the first half of the 21st century, so the study of the children health is especially important.

Objective. Using quantitative methods of evaluation to analyze the incidence of morbidity in child population in Baranovichi within the period from 2005 to 2013.

Objects and methods of investigation. The object of investigation was the information from the form of the state statistical reporting on the number of diseases of child population in Baranovichi. In this work the following methods were used:

the calculation of extensive coefficients, calculation coefficients of the general and primary morbidity; analysis of the reliability of morbidity differences at the end of the study period compared with the beginning; analysis of time series morbidity by aligning a parabola of the first order, and exponential smoothing moving average, calculation coefficient of correlation.

Results and discussion. Significant differences in the direction of increase in overall incidence in 2015 compared to 2007 for the following classes of diseases: respiratory diseases ($t = 16,2$, $p < 0,001$), the eye and adnexa ($t = 4,1$, $p < 0.001$), towards decrease - some infectious and parasitic diseases ($t = 5,2$, p <0,001), injuries, poisonings and some other consequences of influence of the external reasons (t=3,2, p <0,001). Comparative analysis of the primary disease at the end of the study period compared to the beginning showed significant differences in the direction of increasing the incidence of upper respiratory tract disease ($t = 18,7$, $p < 0,001$), the downside for the following classes: Certain infectious and parasitic diseases ($t = 9,5$, $p < 0,001$), injuries and poisonings ((t=2,6, $p < 0,001$**)**. The values of the indicators of the incidence of the primary diseases of the eye and adnexa revealed no significant difference ($t = 1,7$ $p > 0,05$). Based on the values of the general and primary morbidity of children population coefficients of correlation between of general and primary morbidity. They characterize the degree of chronic disease. The coefficient morbidity correlation of the eye and adnexa was the highest for the entire observation period and amounted to 4.2 within 2015.

Conclusions. The coefficient correlation between the general and primary morbidity over the study period did not change significantly, which may indicate a well-established diagnostic and preventive work in the region. However, there is growth in chronic eye disease and adnexa disease.

Yanchencko T., Levdanskaya N.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

TOXICOLOGICAL AND HYGIENIC TESTS AND HAZARD CHARACTERISTICS OF THE HERBICIDES SQUALL AND TYPHOON

Herbicides have now become an integral part of the crops production technology. When used properly, high processing efficiency can be achieved by eliminating the wide range of weed species without damage to crops. Modern crop species and cultivars (hybrids) are characterized by low competitiveness so that without human help they easily lose to weeds that are better adapted to the diverse conditions of the habitat and win without any effort in the struggle for nutrients, water, light and space in the crop. The possibility of weed control has extended through the use of chemical methods. However the massive use of herbicides, higher herbicide appli-

cation rates make it difficult to not only to save the environment but also to protect public health.

The research goal is to determine the parameters of the acute oral toxicity of active substances such as glyphosate and fluazifop-P-butyl and their preparative forms of herbicides, and also to assess the cumulative effect of formulations of Squall and Typhoon.

The acute poisoning is modeled by a single injection of the drug into the stomach of white rats using a needle probe. Various concentrations of drug solution in distilled water are used in the experiments. The introduced doses are calculated according to the active ingredient, they do not exceed the physiological capacity of the stomach. Each dose is tested in acute experiments on 6 to 12 animals with follow-up observation within 14 days and taking into account the character of the symptoms of intoxication, the number of dead animals, the terms of their death.

The research has shown that after a single injection into the stomach of white rats the mean lethal dose (LD50), calculated by probit analysis according to Litchfield and Wilcoxon is 6120 mg / kg (5200÷7200) for glyphosate and 2240 mg / kg (2000÷2500) for fluazifop-P-butyl. It has also been found that after a single injectuion of the preparative form into the stomach of white rats the mean dose (LD50), calculated by probit analysis according to Litchfield and Wilcoxon is 6120 mg / kg (5400÷7000) for herbicide Squall and 1223 mg/kg (1080÷1380) for herbicide Typhoon.

The cumulative properties of the formulations of herbicides Typhoon and Squall have been studied on two groups of male white rats. For 30 days 5 days a week water emulsion of the formulation of herbicide Squall at the dose of 500 mg / kg equal to 1/10 LD50 has been injected intragastric into the first group of rats, and water emulsion of the formulation of herbicide Typhoon at the dose of 122.3 mg / kg equal to 1/10 LD50 has been injected intragastric into the second group of rats.

During the experiment it has been figured out that the formulations of herbicides Squall and Typhoon do not possess cumulative properties at the level of manifestation of lethal effects, however they have general toxic nature with advantageous changes of the biochemical parameters of blood using the herbicide Squall and advantageous features of violations in the liver function of lipid formation and morphological composition of peripheral blood using the herbicide Typhoon.

Yasinskaya E.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

INFLUENCE OF CHEMICAL TOCXICANTS (ACRYLONITRILE, ACH) ON LIVING ORGANISMS

Technical progress of any sector of the economy is inextricably bound using various chemicals. The increasing chemical pollution of the environment as a sec-

ondary consequence undesirable feasibility of dangerous air saturation and water resources hazardous to the human body, and, in addition, creating a change in the chemical environment of the animal and vegetable world. In this connection, great importance is the development and selection of integrating action programs in extreme situations when contaminated environment exogenous chemicals.

Search saving health methods, i.e. methods to prevent human exposure to damaging (critical) concentrations and / or doses of toxic chemicals is the responsibility of preventive toxicology.

Article 14 of the Law of the Republic of Belarus "On the sanitary-epidemiological welfare of population" indicates the need for the implementation of sanitary and epidemiological requirements to the organization and carrying out of actions in emergency situations of natural and man-made, for radiation, chemical and biological safety, including the use of chemical substances, poisons, biological weapons and materials, and to the conditions of work with them, as well as to the conditions of transportation and storage of toxic substances. Therefore toxicological relevant experimental studies are acrylonitrile and acetone cyanohydrin acetone cyanohydrin. Studies on laboratory animals are carried out in order to clarify the degree of influence of toxicants on the body of laboratory animals when simulating emergency conditions with a hit of acrylonitrile and acetone cyanohydrin in the drinking water.

Acute acrylonitrile and ACH simulated stimulated single injection of substances into the stomach of the experimental animals. The solvent used was distilled water. Each dose was tested in 7 animals with follow-up within 14 days of the registration of clinical symptoms of poisoning and intoxication. The volume of doses does not exceed 0.2 ml / 10g body weight.

Quantitative parameters of toxicity were determined by probit analysis by Miller-Treyton method. The main criterion for determining the toxic effect of the mean lethal dose LD50 was the death of half of the group of animals.

Yasyukevich A., Dudinskaya R.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ANALYSIS OF EPIDEMIOLOGICAL AND SOCIAL ASPECTS OF ABORTION

Relevance. Social changes that happened in the world over the last decade have significantly affected the status of women, contributing to the growth of their economic and psychological independence. In this regard, a tendency of conscious regulation of procreation is becoming ever clearer. However, for this purpose some women resort to abortion rather than try to prevent this with modern reliable means of contraception.

Objective. To identify the role of social factors, personal motivation, as well as and moral and ethical responsibility of women in deciding whether to have an abortion through a specially designed questionnaire.

Objects and methods of research. The study focuses on the results of the questionnaire conducted with women who visited Branch 1 of the Minsk Central District Hospital. Intensity factor and the reliability of indicators were calculated as a result of this study.

Results and discussion. Time series analysis by aligning a series of parabolic first order the number of abortions per 100 births in Belarus (1995–2014 years) revealed a statistically significant downward trend in the index for the period under study (R_2 = 0,95, A1 = (–9,4) %) per 1000 women of childbearing age also revealed a steady downward trend index (R_2 = 0.91, A_1 = (–3.3)%).

The largest number of abortions has been observed in the age group of 21–25 years. At the same time, percentage of abortions in the age group of 18–20 years (7,8±2,98)% has been found to be large enough. The absolute number of respondents prefer to have an abortion conducted at a public institution, which indicates the level of confidence in the health system in the country. The share of the reasons that respondents had an abortion, is highest (38,2±5,15)% among women with financial problems. In second reason (22,4±4,42)% is the lack of housing. Thus, three-quarters of respondents have financial problems, unresolved housing issues and are not sure about the future. In addition, the survey results analysis revealed that 30% of respondents under 20 years do abortion when insisted by their partner. Awareness of respondents about the timing of the formation of the embryo is quite high (about 80.0%), which in its turn shows sufficient knowledge in this area. It is necessary to note, however, that awareness in the majority of cases is theoretical and does not constitute grounds for rejection of abortion. Up to 81% of respondents would not give up abortion with full awareness of the terms of the formation of the embryo. The downside is the fact that even a significant number of women over 30 years, which should have experience of prevention of unwanted pregnancies, still resort to abortion as a method of birth control.

Conclusions. Based on the analyzed data, it can be concluded that the main efforts to prevent abortion should be directed at the implementation of family planning programs, counseling on contraception, as well as the implementation of sex education programs, as this issue is socially important and is a leading factor in improving the demographic situation in Belarus.

The results of the post-abortion responses of women to the designed questionnaire has revealed the role of social factors, personal motivation, and moral and ethical responsibility making a decision whether to have an abortion.

Yerofeyeva H.-M.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

BLOOD CORTICOSTERONE LEVEL IN WHITE MICE UNDER THE INFLUENCE OF HEAT AND COLD

Nowadays there has been a rapid human expansion into Antarctica and Arctic regions, aiming to find new mineral deposits and settle new lands. In addition, the civilization development in these regions is observing, where the large-scale using of alternative energy sources, such as sunlight energy, takes place. Extreme conditions in these areas have a strong impact on the body, inducing stress condition. Therefore, a research problem of adaptive human responses to a sharp change in the ambient temperature is present.

Hypothalamic-pituitary-adrenal axis is a stress-realizing system, which ensures the implementation of adaptive responses by releasing of glucocorticoids that mobilize the body's structural and energy resources for the development of overall adaptation. Therefore, research the effects of stress factors such as heat and cold on the hypothalamic-pituitary-adrenal system functioning takes on special significance.

Thus, the aim of this research was to study how the temperature factor effects on plasma corticosterone level in white mice.

In the experiments, white mongrel mice, weighing 20–25 g, were kept in a climatic chamber at 0 °C and 40 °C. The plasma corticosterone level was measured via a radioimmunoassay kit (RIK-B-^{3}H, Russia).

It was found that after exposure to 0 °C the corticosterone level increased in 30 min and 2 h and returned to control levels, while the rectal temperature decreased after 1 h on the average 6,3 °C with a short-term rising in 2 h to 3,1 °C and further reduction. By 2 h the survival rate of animals amounted to more than 60%.

After exposure to 40 °C, the rectal temperature increased in 1 h at 1,3 °C with a peak by 2,5 h and subsequent decrease. The corticosterone level increased once after 1 h in 7 times compared to the control levels and returned to normal level by 3 hours.

Summarizing, it should be concluded that stress impact of high ambient temperature on the hypothalamic-pituitary-adrenal system can be regarded as acute since short-term activation with a significant release of corticosterone in the blood was observing. Regarding cold exposure, there is a gradual activation of the hypothalamic-pituitary-adrenal axis, which is confirmed by the cyclical secretion of corticosterone in the blood.

Zayceva N., Lazar I.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

EPIDEMIOLOGICAL ANALYSIS OF THE CHILDHOOD INCIDENCE RATES OF THE PERVOMAISKY DISTRICT OF MINSK SOME INFECTIONS DISEASES

Children′s infections are a group of infectious diseases, which are registered in the vast majority in a childhood, are transmitted from the patient to the healthy child and are capable to get epidemic distribution (that is, have a flare or mass character).

The aim of the present study was to carry out the analysis of a case rate by some infectious pathologies recorded among the children′s population of the Pervomaisky district of Minsk.

In the observation period from 2008 to 2014 the analysis of indicators showed that there are statistically significant differences in some years and for the end of the period studied in the comparison with the beginning for a SARS, poliomyelitis, herpes infection, salmonellosis, and scarlet fever. In case rate indicators by an angina and a trichinosis of statistically significant differences were not found. Analysis of long-term dynamics in the period 2008–2014 is not allowed to reveal the obvious trends in the incidence of salmonella, trichinosis and angina. In the dynamics of the morbidity of a SARS two tendencies become perceptible: since 2008–2011 increase of a incidence rates, since 2011–2014 depression of a incidence rates. The unstable tendency in dynamics of a incidence rates was noted by a poliomyelitis (R_2 = 0,6758); herpes infection (R_2 = 0,5194); scarlatina (R_2 = 0,4676). Analysis of the structure of infectious morbidity of the child population of the Pervomaisky district of Minsk has showed that both at the beginning and at the end of the observation period the 1st rank place is taken by SARS (56.00%), the 2nd place other infectious diseases (38.00%), the 3rd place flu (3.50%), the 4^{th} – pneumonia (0.64%), the 5th place – angina (0.23%).

The carried-out epidemiological analysis showed that in the long-term dynamics of child morbidity of the Pervomaisky district of Minsk for the period 2008–2014 some infectious diseases taped various tendencies. It will allow to develop further the correct strategy of holding preventive and anti-epidemic actions.

Zuravleva S.[1], Shubianok A.[1], Bulanava K.[1], Bakunovich A.[1], Rutkevich V.[1], Bichan O.[3], Sidarenka V.[2], Levdanskaya N.[1]

[1] International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;

[2]Belarusian State Medical University, Minsk, Republic of Belarus

[3]Belarusian State University, Minsk, Republic of Belarus

SOME FEATURES OF THE REGULATION OF PLATELET AGGREGATION IN PREECLAMPSIA

Preeclampsia (PE) is one of the most dangerous disorders of pregnancy and it is a direct threat to the health of mother and fetus. This condition is characterized by a progressive thrombocytopenia which is accompanied by increased intravascular platelet aggregation. The main objective of the study is a detailed study of platelet aggregation mechanisms and identifying methods to reduce platelet aggregation to normal rate.

Analysis of the data on the concentration of thrombopoietin which is a key stimulator of thrombopoiesis has showed that as PE progresses, its level in plasma increases 2.8 times at risk group and 15.6 times at an average degree of severity of PE. These data can be used as an early diagnosis of PE.

It is also discovered that increased platelet aggregation ability in pregnant women with a risk of developing PE can be found in its initiation of low concentrations of ADP. The value of the degree of aggregation in response to ADP in $2{,}4\times10^{-7}$M concentration is 7.39±1.0 for platelets in pregnant women with PE and 4.16+0.33 in the control group.

It is known that increased platelet aggregation is a Ca^{2+}-dependent process. Studies of the intracellular concentration of Ca^{2+} ions have showed that the basal level of free Ca^{2+} in resting platelets in pregnant women with PE suspended in HEPES buffer without Ca^{2+} does not differ significantly from that in pregnant women with physiological pregnancy (31,1±7,4) nmol / l and (27,6±2,3) nmol / l, respectively. While basal Ca^{2+} is higher in women with PE group than in pregnant women with normal pregnancy (82,1±4,2) nmol / l (60,6±3,5) nmol / l respectively in Ca^{2+}-containing buffer, it indicates a significant transmembrane influx of these ions into the cytoplasm.

It is obvious that Mg^{2+} ions are able to provide a direct influence on both the depolarization of outer membranes as placental vascular smooth muscle cells and platelets because ions Mg^{2+} and Ca^{2+} are competitive inhibitors of each other. During the pregnancy the need for Mg^{2+} ions is increased by 3–6 times. The deficiency of Mg^{2+} progresses in PE as a result of the collapse of dense bodies in platelets which are depots of Mg^{2+}. It is figured out that it is possible to carry out the correction of the increased platelet aggregation using Mg^{2+}-containing drugs in combina-

tion with ATP which deficit is also due to the collapse of the platelet dense bodies in pregnant women with PE (see Table 1).

Table 1. – Indicators of platelet aggregation in pregnant women with preeclampsia before and after the treatment

Concentration of ADP (M)		Degree of aggregation		Time of aggregation		Rate of aggregation	
		$-Mg^{2+}$	$+Mg^{2+}$	$-Mg^{2+}$	$+Mg^{2+}$	$-Mg^{2+}$	$+Mg^{2+}$
$2,5 \cdot 10^{-6}$	B. treat.	55.36±3,7	5,35±2,3*	0:44±0,04	0:47±0:03	38,69±2,5	8,45+3,9*
	A. treat.	8,2+0,02*		0:54±0,01		6,68±0,3*	
$1,25 \cdot 10^{-6}$	B.treat.	26,36±3,3	4,05±0,1*	1:33±0,02	0:33±0:01*	30,0±2,7	3,9±0,04*
	A. treat	6,27±0,05		0:49±0,01		7,24±0,04	
$2,5 \cdot 10^{-7}$	B. treat.	7,39±1,0	4,4±0,98	1,10±0,05	0:31±0:03*	9,07±1,98	3,53±0,2*
	A. treat.	No aggr.		No aggr.		No aggr.	

But, Ap_4A turns out to carry a more effective reduction in platelet aggregation because it reduces ADP-stimulated influx of Ca^{2+} into the cytoplasm of platelets in PE to the level typical for a normal pregnancy.

SECTION 3

PROBLEMS OF MODERN ENVIRONMENTAL SAFETY

(BIO-MONITORING, BIO-INDICATION, BIO-REMEDIATION, RADIOECOLOGY AND RADIATION SAFETY, ENVIRONMENTAL MONITORING, MANAGMENT AND AUDIT, INFORMATION SYSTEMS AND TECHNOLOGIES IN ECOLOGY)

Asipchyk M., Chernetskaya A.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

INFLUENCE OF DRAINAGE RECLAMATION ON AMPHIBIOUS OF THE PETRIKOV DISTRICT

Anthropogenic landscape changes adversely affect the conditions of existence of most species of amphibians. The number of amphibians is reduced as a result of direct destruction and deterioration of environmental conditions in the territories of their habitat.

Drainage reclamation is one of the major activities carried out by man that affect the number of amphibians. In a result of reclamation work the amphibious area of habitat is not only reduced, but the number of places suitable for the development of the most vulnerable stages of their lives - the larvae and embryos are reduced too. And it leads to a fragmentation of the remaining populations.

On the lands of the Petrikov district reclamation work has been conducted extensive. Basically reclamation work has been conducted near floodplain the Ptsich River. However, Petrikov district is located on the Belarusian Polesie, the territory in which there are the largest number of species and the heterogeneity of the composition of amphibians.

To account amphibians were chosen two territory, which were subjected to intense reclamation work – drainage canal and upland meadow. In the study of amphibian fauna of the region were found 46 individuals belonging to 8 species of 5 families belonging to the order of tailless (Anura). There weren't found any representative of the tailed (Caudata).

27 amphibians of following species were found near the drainage channel: Common spadefoot (Pelobates fuscus) – 4,3±0,9 ind/ha, Pool frog (Rana lessonae) - 7,5±2,3 ind/ha, Common frog (Rna temporaria) – 3,4±1,1 ind/ha, Common toad (Bufo bufo) – 3,1±0,7 ind/ha, Marsh frog (Pelophylax ridibundus) – 4,1±0,3 ind/ha, European green toad (Bufo viridis) – 3,5±0,6 ind/ha, European tree

frog (Hyla arborea) – 1,2±0,2 ind/ha, European fire-bellied toad (Bombina bombina) – 2,2±0,5 ind/ha.

19 amphibians of following species were found at the upland meadow: Common spadefoot (Pelobates fuscus) – 7,3±1,2 ind/ha, Common frog (Rna temporaria) – 4,2±1,8 ind/ha, Common toad (Bufo bufo) – 3,3±1,3 ind/ha, European green toad (Bufo viridis) – 2,6±0,5 ind/ha, European tree frog (Hyla arborea) – 2,2±0,3 ind/ha, European fire-bellied toad (Bombina bombina) – 1,4±0,8 ind/ha.

On the drainage canals Marsh frog (Pelophylax ridibundus) and Pool frog (Rana lessonae) are the dominant species, that reach the highest density in the zone of reclamation channels – 4,1±0,3 and 7,5±2,3 ind/ha, respectively.

On the upland meadow Common spadefoot (Pelobates fuscus) has the highest density 7,3±1,2 ind / ha.

In a result of studies it is clear that the most favorable biotopes for amphibian habitat are in areas that were exposed to the drainage reclamation – reclamation canals. The species composition of amphibian populations in the drainage canals in 1,5 times higher than of drained grasslands. There marked not only the greatest biodiversity of amphibians (8 species), but also the highest density of amphibians (25,6±1,4 ind/ha).

Asipchyk M., Zagortseva E., Golubev A.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

FEATURES OF GROWTH AND REPRODUCTION, PARTHENOGENESIS OF MARBLED CRAYFISH IN LABORATORY CONDITIONS

Freshwater crayfish have a tremendous impact on freshwater ecosystems due to their large size and dietary habits. Thus, the appearance or disappearance of cancers, replacement them with others, not characteristic for the habitat species can lead to disruption of the ecological balance and irreversible consequences.

Recently in Europe there is a trend for the appearance of non-indigenous species of North American crayfish. One of them is the marbled crayfish (Procambarus fallax). Marbled crayfish attract special attention because they are the only obligate triploid parthenogenetic decapod that produce genetically homogeneous offspring. This species multiplies rapidly, matures early and has a high fertility, thus creating competition to endemic species of freshwater ecosystems crayfish. In addition, they are carriers of crayfish plague (Aphanomyces) a highly contagious disease that causes mass death of European native crayfish species.

For studying the characteristics of growth and reproduction of crayfish marble 2 generation were taken in the laboratory: from 09.11.2015 (1) and 06.01.2016 (2).

Then all individuals were been sected on the aquariums, depending on the weight. Changes in average weight during the experiment are presented in Table 1.

Table 1. – The average weight of individuals during the experiment

Generation 1						Generation 2			
Age (days)	Aquarium No.					Age (days)	Aquarium No.		
	1–1	1–2	2–1	2–2	2–3		3–1	3–2	3–3
	Number of individuals						Number of individuals		
	7	6	6	5	5		5	5	6
	Average weight (mg)						Average weight (mg)		
158	58,6	160,6	215,5	71,4	44,3	154	251,3	198,6	157,2
178	126,6	260,3	321,1	129,04	83,7	180	426,6	371,7	305,8
212	233,6	438,7	593,4	298,36	319,5	223	1284,9	1043,9	641,8
238	398,8	627,3	1076,3	439,34	476,1	239		1480,3	918
281	1153,33	832,4	1345,1	858,6	1374				
297	1311	1756,3	1898	1025,25	1391,6				

The main factor influencing the growth and reproduction of marbled crayfish is the temperature. The nature of marbled crayfish temperature ranges is from 8 °C to 30 °C. In the laboratory conditions, the temperature varied from 15 °C to 30 °C. Typically marbled crayfish reproductive age beginning at 20–25 °C from 141–255 days of life.

Since the temperature in the laboratory varied all the time, and majority of the time barely reached 20 °C, so the first clutch in the individuals of the first generation aged were only at 297 day. The clutch of individuals of the second generation, from the aquarium 3–2, appeared at the age of 239 days. Usually in a laboratory conditions at a temperature below 15 °C marbled crayfish stops multiplying.

The data obtained can be used to further explore the characteristics of growth and reproduction of the marble cancer. And also for the development of methods of preventing the spread of invasive species in freshwater ecosystems

Astreyko V., Kapitsa V.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ENVIRONMENTAL ASPECTS OF MANAGEMENT IN TEXTILE INDUSTRY

The textiles industry has a large pollution problem worldwide. The main issue is water pollution. It is estimated that 17 to 20% of industrial water pollution comes

from the textile industry itself. Most of environmental aspects are associated with water pollution.

According to definition of ISO 14001, environmental aspect – element of activity of enterprise, its production or service, which can have an impact on environment.

Most of environmental aspects of textile industry are related to dyeing and finishing of fabric. These processes usually use a considerable amount of water and energy. The wastewater generated by the industry is high in BOD, COD, pH, temperature, color, turbidity and toxic chemicals. These polluted effluent need to be treated chemically to remove the hazardous materials and chemicals so that the wastewater will comply with prescribed limits and can be discharged into the public sewer or into aquatic bodies.

One way to reducing the environmental burden is using of foam technology of finishing. Essence of foam technology is replace the most part of liquid by air (always available and free). Therefore decreasing moisture content of finished material (in 3–4 times) and correspondingly reducing heat and energy consumption to moisture removal in the heat treatment processes. Realization of foam finishing technology can significantly reduce the amount of industrial waste water, increase community occupational safety.

As an approximate analog of foam technology of finishing can be considered essentially new technology of finishing of textile materials in the atmosphere of supercritical carbon dioxide. The technology of finishing of textile materials in the atmosphere of supercritical concentration of carbon dioxide has a number of essential advantages before traditional technology of dyeing with use of water dyeing liquor: stages of preliminary preparation of water, its special cleaning after dyeing and returning of water to a production cycle are excepted , sewage isn't formed, energy economy is attained (lack of a stage of drying), the possibility of pollution of the atmosphere is eliminated (gas after using remains pure), time of engineering processes is reduced, dispergators and textile excipients aren't required.

There are several techniques for the treatment of effluents, such as incineration, biological treatment, absorption onto solid matrices, etc. However, these techniques have their drawbacks, such as the formation of dioxins and furans, caused by incomplete combustion during incineration; long periods for biological treatment to have an effect, as also the adsorptive process, that is based on the phase transfer of contaminants without actually destroying them. According to this scenario, many studies have been carried out with the aim of developing new technologies capable of minimizing the volume and toxicity of industrial effluents. Amongst the many reported cases are those based on the use of specific microorganisms, and degradation using advanced oxidation processes (AOP) and heterogeneous photocatalysis.

It was concluded that the synthetic textile dyes represent a large group of organic compounds that could have undesirable effects on the environment, and in addition, some of them can pose risks to humans. The increasing complexity and

difficulty in treating textile wastes has led to a constant search for new methods that are effective and economically viable.

Bayok K., Chernetskaya A.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

HABITATS AND NESTING'S OF A WHITE STORK (CICONIA CICONIA) IN THE CONDITIONS OF THE MINSK DISTRICT

The white stork is a symbol of Republic of Belarus therefore; researches on this object are annually conducted. Proceeding from it we have conducted researches on questions of biology and ecology of a white stork in the territory of the Minsk district. Questionnaire is chosen as the main method of a research. Was created the questionnaire "Habitats and nesting of the white stork in conditions of the Minsk district". The questionnaire included thirteen questions and mentions the highlights allowing to determine the level of awareness of students in the field of biology, ecology and places of dwellings and nesting's of a white stork. In the course of the study were interviewed one-hundred and fifty people. The respondents were students of the 1-st and 3-rd course ISEI BSU, and also students of the 2-nd course BSPU of M. Tank.

The results of questioning of students of Minsk have shown the following results (proposed percentages of larger and smaller quantities):

a) the greatest distribution of a stork white is registered in the Minsk region (40%), the smallest – in Vitebsk (13%), which is not consistent with the published data of the Belarusian ornithologists (Ph.D., Samusenko I. E., 2012);

b) the most frequent storks in spring (51%), but had the opportunity to observe them and in autumn (8%);

c) the most frequent support for the nesting grounds of the white stork is: poles (50%) and water towers (21%);

d) more than 58% in settlements meet from 1 to 3 nestings of a white stork;

e) the most widespread height of placement of a nest of a white stork – 5–10 m (69%);

f) the stork to nest, generally in couples (81%), but at flying away on a wintering to the warm countries they can be observed in pack (8%);

g) the amount of eggs (chicks) in a laying varies from 2 (43%) to 3 (28%);

h) the greatest number of packs (flock) of white storks in Belarus is observed in August – September (47 and 18% respectively) and in the spring – in March and April (10 and 19% respectively);

i) packs (flock) of storks totaled from 10 to 20 birds (48%), the maximum quantity could reach 300 individuals (Ph.D., associate professor, A. V. Handogiy: oral message, Volozhinsky district of the Minsk region);

g) the ratio of urban population to the white stork is positive in 85% and negative in 17% of cases;

k) the ratio of rural population to the white stork in 79% positive, and only 3% – negative;

l) on the question, of where winters stork, answered correctly only 30% of students;

m) the final question was the value of the white stork for man and nature: the positive value of 98% but 2% of people said negative value, stating the fact that he is a carrier of many diseases of both animals and humans.

Having studied references (Samusenko, I. E., Handogiy, A. V.) and having conducted own researches, it is possible to draw a conclusion that the number of population is stable. The current state of population of a white stork in the Minsk district of the Minsk region doesn't cause alarm.

Belyatskaya E.[1], Kolpashchikov V.[2]

[1]International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;

[2]Institute of heat and mass transfer named after A. V. Lykov of the National Academy of Sciences of Belarus, Minsk, Republic of Belarus

ASSESSMENT OF TECHNOLOGICAL LOSSES IN THE SUPPLY PROCESS GAS

One of the most important tasks of the enterprise is reduction of losses of Liquefied Petroleum Gas (LPG). To explore opportunities to reduce losses of gases in the work produced by quantitative assessment and analysis of losses in each process step in the transportation of gas to consumers by the example of gas pipeline branch, a gas distribution station (GDS) and petrol station for state production association (SPA) "Beltopgaz".

Loss – the amount of gas inevitably lose the technological process of collection, preparation and transportation, in connection with impossibility of implementation of these processes without the losses at the present level of equipment and technology and in full compliance with existing norms, rules and regulations..

Describes the main processes that lead to loss of natural and liquefied gases are:

Gas consumption for technological needs. Such consumption occurs:

- when refueling odorization installations;
- when blowing dust (freezing, filters, etc.);
- purge areas of communications GDS;
- grazing areas of communications GDS;
- when carrying out the bombings (checks operation) safety valves on GDS;
- with the loss of natural gas pipeline-branch and GDS;
- if technically unavoidable losses of liquefied gas at the petrol station;
- in emergency situations in the gas distribution systems (unexpected loss);

• the through damage;
• when emissions of combustion products.

The results of the work prepared instructions for the computation of norms of losses of natural gas during exploitation of trunk gas pipeline-tap and GDS, as well as instruction on calculation of norms of losses of liquefied natural gas for filling stations which are on balance of gas distribution organizations of the “Beltopgaz”.

Bezzabava O., Lobkova O.

East State Inspectorate on Nuclear and Radiation Safety
of State Nuclear Regulatory Inspectorate of Ukraine, Kharkiv, Ukraine

DEVELOPMENT OF STAFF QUALIFICATION IN THE SPHERE OF RADIATION SAFETY

Solution of the problem connected with ensuring of the person radiation safety (both the patient, and the staff which works with sources) during carrying out medical diagnostic researches and treatment with use of ionizing radiation sources depends on a set of factors.

Besides observance in a medical institution of three radiation safety basic principles, ensuring protection means and presence of an qualitative equipment for carrying out diagnostics and therapy, and also observance of conditions and correctness of its operation; observance, not exceeding, and also restriction of the staff exposure levels and patients' doses; correctness of medical exposure's procedure justification and correctness of procedure's technology carrying out; presence and using of individual protection means from radiation's influence etc.

In other words, radiation safety as a whole depends on existence and functioning of quality assurance system of exposure's procedures and, naturally, control of its observance.

Despite importance of all quality system's components of carrying out medical exposure procedures, nevertheless on the first place in ensuring of radiation safety it is necessary to put competence level of the staff.

In practice, very often we face that at carrying out procedures of beam diagnostics, and more rarely at treatment, the staff sometimes ignores all requirements of radiation safety and protection optimization as own, so and for patients' who, in turn, without knowing all possibilities of protection optimization and requirements to performance of exposure procedures, can't check own rights to protection from ionizing radiation. Unfortunately, in most cases, such violations of requirements are connected with elementary absence of staff's knowledge on radiation safety.

In 2010 in the frames of the cooperation between the State Nuclear Regulatory Inspectorate of Ukraine (SNRCU) and the Swedish Radiation Safety Authority (SSM) by representatives of 8 regional inspections of SNRCU was developed the program and contents of the course “Radiation safety and quality assurance in medical practice” based on Ukrainian and international regulatory documents on radia-

tion safety and quality assurance in medical radiology. The course was developed on the base of the one, carried out by SSM, and adopted to the needs of the Ukrainian specialists.

In 2011–2013 27 courses in 26 cities of Ukraine, which was heard about 490 listeners from various medical institutions were carried. After each course listeners filled a questionnaire in which nearly 85% of them noted out that they learned for themselves new information on problems of radiation safety ensuring of staff and patients. As the most actual topics for listeners, were chosen next ones: "Requirements to quality assurance system of carrying out medical procedures with use of ionizing radiation sources", "Radiation safety of patients and the staff", "Practical questions of radiation safety organization in medical institution" that testifies about need of carrying out similar seminars, both for young specialists, and for more skilled ones. Most of listerens (95%) estimated the contents of the course on five points on a five-point scale, and on the question "Whether you will recommend to your colleagues to take a course" answered positively.

Every year use of ionizing radiation sources in the medical purposes is increasing exetremely. Respectively number of staff who works with radiation sources is increasing too. That is why carrying out of such courses is critical for increasing radiation safety and functioning of quality assurance system of exposure's procedures.

Bondaruk R., Luchina V.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

TRYING OF ANALYZING TERRITORIES OF PRESERVES AS AN OBJECT OF ECOLOGICAL LAW

Preserves are the territories (water area), that has particular importance for the preservation or restoration of natural systems and their components and to maintain the ecological balance. State nature reserves may have a different profile, also it could be:

• complex (landscape), for the preservation and restoration of natural complexes (landscapes);

• biological (botanical and zoological), for the preservation and restoration of rare and endangered plant and animal species, including valuable species in the economic, scientific and cultural relations;

• paleontological, intended to preserve the fossil; et. cet.

In 2014, the total area of nature reserves of the Republic of Belarus amounted to 1.107,3 thousand hectares, or about 5.3% of the country's area and 70% of the total area of specially protected areas (Ministry of Nature and Environment, 2010). Most environmental violations carried out in the reserve. The main offenses in relation to reserves as a specially protected natural territory are a violation of the regime of protection and use of specially protected natural territories, violation of environ-

mental safety regulations, illegal destruction, removal or damage to trees and shrubs, or other vegetation, as well as some others. In Environmental Protection Act of Republic of Belarus October 20, 1994 № 3335-XII and in the "Law on Protected Areas," Forest Code, there is no direct evidence to limit a particular type of forest management activities in the reserve. Such restrictions must be prescribed by the Regulations on Protected Areas, for each particular area separately. However, in practice these limitations are not always specified and not for all territories. For example, of the 37 Republican reserves created / converted by the Council of Ministers Decree of the Republic of Belarus of December 27, 2007 № 1833 "About the republican nature reserves", only 21 (of noted there) has any limits on different types of forest management activities. A 16 do not have any restrictions, except for the following wording "... prohibits the damage and destruction of trees and shrubs, a violation of natural soil, except for agricultural land contours, performing forestry work, as well as work on the conservation and protection of forest resources."

The solution to this problem starts with tighter control and the separation of reserves from the outside world. It's necessary: 1) develop ecological trails. 2) enter special staff into these areas, rangers and ecologists who will observe and carry out regular monitoring of the territory. Tours conducted in reserves, will enhance environmental awareness among the population, in the excursion program we can also include a material liability for environmental offenses**.**

Borodaeva E., Len E.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE STUDY OF WATER CONSUMPTION BY INDUSTRIAL ENTERPRISES. THE INTRODUCTION OF WATER RECYCLING SYSTEMS

Recycling of water to address the environmental and economic objectives: substantially (to 85–95%) to reduce the water consumption of industrial enterprises to reduce losses of valuable components from industrial sewage of enterprises, to avoid paying for the disposal and penalties for exceeding established standards.

Industrial enterprises, especially machine-building and metalworking, consume a lot of fresh water. As a result of technological process the water is polluted with heavy metals, organic and inorganic compounds. Currently used physical-chemical methods for industrial wastewater treatment at the enterprises with the aim of water reuse.

Water recycling may be a single system for the entire industrial enterprise or individual cycles of circulation of water for a single workshop or group of workshops.

When full recycling is a fully closed system, which allows reuse of waste water after she will complete a full cleaning cycle. Complete recycling can not only elim-

inate the dumping of sewage into drains or the aquatic environment, but also saves the company's money.

Many enterprises of Belarus are equipped with water recycling systems.

Britan E., Ryshkel O., Levdanskaya N.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

BASIDIOMYCETES AS INDICATORS OF THE STATE OF THE ENVIRONMENT IN MINSK

There is the *National Environmental Monitoring System* in the Republic of Belarus to provide information on the state of the environment to public authorities, legal entities and citizens. This information is necessary to make management, design and technological solutions in the field of conservation of biological diversity, sustainable use of plant resources and maintaining environmental quality.

One of the types of the National Environmental Monitoring System in the Republic of Belarus is the monitoring of flora. It is based on the methods of phytoindication and it is a system of long-term and regular observations of flora objects.

These observations allow assessing the current state of resource-based species of plants and fungi on the territory of Belarus, to identify the factors that adversely affect the resource potential of wild-growing commercially valuable species. In addition it is possible to make a forecast of the development and changes under the influence of natural and anthropogenic factors. This complete information support is necessary for decision-making in the field of forestry production, preservation and rational use of flora resources, ecological safety of the entire population.

Mushrooms are often used as an essential component in assessing the state of ecosystems and in the environmental monitoring. And it is not a coincidence. They are involved in the cycle of biogenic substances. The destruction of most of the plant detritus in soils and soil cover, especially in the woods takes place with the direct participation of fungi. Thus fungal biota is the converted reflection of vegetation.

The objects of our research have been basidiomycetes: Granulated bolete – *Suillus,* Cep – *Boletus edulis,* Chanterelle – *Cantharellus cibarius,* Fragile brittlegill – *Russula fragilias*, Birch bolete – *Leccinum scabrum,* Tinder fungus – *Fomes fomentarius,* Fly amanita – *Amanita muscaria,* Red-capped scaber stalk – *Leccinum aurantiacum.* The forest parks located in the city of Minsk: Forest Park Zeleny Lug, Tsnyanskoe Reservoir, Forest Park Novinky have been chosen as the study area.

In the course of our examination of the forest parks of Minsk 8 species of basidiomycetes which belong to the class Agaricomycetes (*Agaricomycetes*): Gran-

ulated bolete, Cep, Chanterelle, Fragile brittlegill, Birch bolete, Tinder fungus, Fly amanita, Red-capped scaber stalk were found.

It should be noted that the richest fauna of mushrooms with such prevailing species as Chanterelle (25.7%) and Fragile brittlegill (21.2%) was registered on the territory of Tsnyanskoe Reservoir. The highest occurrence index which depends on the forest cover where the fungus grows has been seen for Chanterelle (25,7±5,37).

Buchatskaya S., Zhuk E.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

FAIRY TALE AS A MEANS OF ECOLOGICAL EDUCATION OF PRESCHOOL CHILDREN

One of the very important and urgent problems of the society is the problem of ecological education. Childhood – a period the child is just beginning to explore the world and their position in this world. There is the need to build ecological literacy from preschool period.

On the base of the state educational institution "Slonim preschool kindergarten № 15" we explored the ecological competence of preschool children. Fairy tale has been chosen the basic method of ecological literacy. We have identified the level of ecological literacy through interviews and watching to evaluate the efficiency of using this method.

In the exploration involved 18 senior preschool children. 7 stories were selected from a simple story to a more complicated:

"Why land has the green dress" (A.Lopatina);

"Who decorates the earth" (A. Lopatin);

"The tale about the rainbow" (G. Verina);

"Kate and ladybird" (T. Shorygina);

"Swallow" (K. Ushinsky);

"Friend of the heart" (G. Skrebitsky);

"Strong grass" (M. Skrebtsova).

The period of studying fairy tales was 3.5 weeks.

Preliminary explore of level of ecological knowledge identified through watching and interviews gave the following results: a high level – 38%, middle level-40%, low level – 22%.

After reading the fairy tales was marked dynamic of ecological knowledge. High level of knowledge has risen from 38% to 56%, middle level decreased to 33%, low level decreased in 2 times (from 22% to 11%).

Analysis of the results of the explore showed that fairy tales are an important form getting relevant knowledge in preschool institutions for this age group and give a positive effect on the children cognitive ability.

Burya S., Borkovskiy N.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

PROGRAM AND RESULTS OF PROCESSING DATA ON TOTAL OZONE AMOUNT

The Earth's atmosphere is the native habitat of mankind and all biosphere of Earth. For this reason stability of its structure represents a necessary condition of survival and quality of life of mankind. In recent years, extremely great value is attached to problems of climate change of Earth and destruction of an ozone layer of our planet. Therefore, researches of characteristics of gas and aerosol composition of the atmosphere are one of the central problems of the modern physics and chemistry of the atmosphere. These researches are caused by need of detailed studying of natural state of the atmosphere for climatology and meteorology, and need of monitoring of anthropogenic impacts on climate of Earth and an ozone layer of our planet.

Now around us there is a huge number of databases that are issued in the form of large numerical tables. These tables are completed by results of the automated pilot studies; information which was collected as a result of overseeing by any object or the phenomenon; data of sociological polls and many other. Therefore great value is made by tools for representation of a data set and results of their processing in a visual form.

The global purpose of present work is to create the program for detection of ozone anomalies for numerical data of the OMI (Orbital Measurement Instrument) device and representing of this information in a graphic form.

Primal problem: creation of the program processing satellite data and outputting the map of concentration for the desired period in a dynamic look.

Daily uploaded files with massifs of numbers from the OMI device on the FTP server of NASA are a source of input data for our program of visualization of small components of the atmosphere.

The OMI device is intended for measurement of the common contents and a profile of ozone, and for measurement of content of such gases as NO_2, SO_2, HCHO, BrO and OClO.

The algorithm of reading and processing of satellite data includes the following steps.

1. Beginning of tracking of errors of reading file.
2. Detecting starting values of longitude and latitude.
3. Filling of headings of longitudes.
4. Filling rectangular matrix with total ozone values for globe.
5. Comparing actual values with “normal” ones.
6. Drawing corresponding graphs (including color mapping on earth projection).

As a result, the program under consideration allows revealing the abnormal areas in an ozone layer, tracing the extreme concentration of aerosols, extracting and investigating statistical information on the given parameters. Moreover, the developed program can form a basis for further researches of this subject domain.

Chernyuk V., Kapitza V.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ENVIRONMENTAL RISK ASSESSMENT OF THE IMPACT OF NATURAL FACTORS ON AGROECOSYSTEM

In modern conditions, agriculture remains the most vulnerable sector of the national economy in regard to the impact of climatic factors because of the agroecosystem among the human communities have the most interaction with environmental factors. In this connection there is an economic interest in the modeling of the impact of environmental factors (especially climate) on agricultural systems. This process is particularly relevant in relation to climate change and the spread of more productive varieties and introduction of intensive technologies of cultivation of agricultural crops, because the impact of extreme meteorological factors in such circumstances is a cause of serious economic losses from death or yield reduction, or damage to the plantations themselves (in the case of long-term plantings).

Assessment of damage to agriculture, adverse weather factors acquires great importance for the establishment of compensation and justification for the relevance of the preventive protective measures. One of the most important influences is the impact of drought and frost.

Temperature oscillation during the year is typical for our climate. Such oscillations adapted as the annual cycle of agriculture in our country and agricultural crops grown in our climate.

Analysis of the practice of assessment of damages from emergency situations can also be taken into account for assessing harm from exposure to adverse factors.

There is a regulatory unit of analysis of the economic damage from the negative influence of economic activity to assess the damage from emergency situations (ES).

Conducting socio-economic studies of ES allows you to comprehensively assess the economic damage on the basis of actual costs.

Emergency situation of natural character connected with geological, meteorological and hydrological hazards, forest and grassland fires, fires grain arrays, underground fires fossil fuels.

In the case of measuring economic losses from adverse and dangerous weather events (AWE and DWE) in agriculture, it is necessary to consider features of the evaluated object and its critical periods of maximum sensitivity to the effects. The

most exposed to temperature fluctuations are crops. Among them it is necessary to allocate the objects most susceptible to frost and (separately) drought (extremely high temperatures).

In the first category should include winter and perennial crops.

They are characterized by winterkill or freezing vegetative organs, leading to disease development or death.

In assessing the impact DWE must consider not only temperature, but also the period of exposure and the combination with other factors increasing sensitivity of the object and causing damage.

Danchenko A., Lemiasheuski V.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

INFLUENCE OF EXPOSURE HELIUM-NEON LASER AT A FRACTION OF METHEMOGLOBIN AND GLYCATED HEMOGLOBIN

Blood is a liquid body tissue, which provides transport of all resources and exchange products for other cells and tissues of the body. In this regard, human blood parameters are a very important feature of health status that reflects its state at a given time. Since the blood is quite labile tissue, so its reacts to external and internal influences. Hemoglobin fractions are its basis, a helium-neon laser of low-intensity radiation was selected as a tool to influence the blood. Irradiation of helium-neon laser allows to achieve photobiological biostimulation effect that occurs at low-intensity radiation (λ = 632.8 nm). This effect occurs not only when irradiated blood but also tissues areas with any inflammatory processes. The laser beam is a means for vasodilation, increasing the number of hemoglobin complexes with NO, increasing the amount of erythrocytes, hemoglobin and leukocytes.

Hemoglobin is one of the leading acceptor of radiation energy. Irradiation causes a conformational change in the molecule, which leads to increase its affinity for oxygen. The laser radiation can increase the activity of cytochrome b558III on the membranes of red blood cells, as well as increase transformation methemoglobin to oxyhemoglobin form. However, the effect of helium-neon laser at glycated hemoglobin is not described in the scientific literature.

Methemoglobin is an important indicator of the overall state of the blood, its ability to carry oxygen to the tissues. It is a hemoglobin containing oxidized form of iron ion (Fe3 +) is not able to attach the oxygen, and hence to carry out its transport to the tissues. The blood methemoglobin is constantly present and is recovered in an amount of up to 1%. The rise of this level is promotes to development of methemoglobinemia, which carries the symptoms such as intense blue-brown skin color (15%), hypoxia, anemia (60%) and death induced by it (70–80%). Although there is

a species of genetically induced methemoglobinemia, the vast majority of it is presented in a form which received in the postnatal period and appears as a result of radiation or the use of toxic substances. Also, during the in vitro storage of blood samples a methemoglobin concentration increases over time, which is one of the factors that complicate this process. It is therefore important to check and control the value of methemoglobin in the blood.

Glycosylated hemoglobin (HgbA1) is a complex of hemoglobin A with glucose, which is the result of non-enzymatic chemical reaction, glycation. Glycation is a process of accession to the hemoglobin A of glucose molecules, reaction is irreversible and the speed is proportional to the level of blood glucose over the life of the erythrocyte (120 days) – i.e. glucose content in the blood during this period (normal 3.3-5.5 mmol/l). On this basis, it is used for the diagnosis of diabetes. The normal level of glycated hemoglobin in the range from 4% to 5.9%, and there is an increase in diabetes its value to 6.5% and higher. There are several forms of glycosylated hemoglobin: HbA1a, HbA1b, HbA1c, the latter of which is the primary by the fraction in the blood and most fully reflects glycemia. As blood glucose levels indicates the presence or absence of diabetes, is also very important to control and verify (about once a quarter) in the blood level.

Thus, undoubtedly important for physiology and medicine is a study on the response photoreaction and adaptation of blood system, and in particular hemoglobin, to irradiation of neon-helium laser.

Davydova I., Vinskyi V.

Zhytomyr State Technological University, Zhytomyr, Ukraine

THE ESTABLISHMENT OF INFORMATION-CONSULTATIVE CENTERS IN ORDER TO ENSURE SAFE USE OF NON-WOOD FOREST RESOURCES ON THE TERRITORY CONTAMINATED BY RADIONUCLIDES

The accident at the Chernobyl NPP caused significant contamination of the territory of Ukraine. Forest plantations performed their natural functions and protected settlements and agricultural areas from more severe contamination. However, forest accumulated considerable amount of radionuclides which caused their accumulation in different species of plants and animals. Forests of Ukrainian Polissia were severely contaminated by radiation. At the same time, forests of these regions are rich in medicinal and berry-like plants and mushrooms; large areas of pine and birch plantations, which are traditionally broached, grow there; the population of the region widely uses forest pastures and hayings. Therefore, it is necessary to rise safety of population living on the territory contaminated by radionuclides: to rise the level of awareness of the population living on the territories of Ukrainian Polissia as for the use of non-wood forest products by establishing information-

consultative centers in Zhytomyr. As far as non-wood forest products are the part of the local population's ration and, to a considerable extent, they form the level of internal irradiation, the knowledge obtained in consultative centers allows decreasing the risk from these products use.

To gain the objectives of the establishing information-consultative centers:

1. To establish information-consultative centers for giving consultations on the possible use of non-wood products on the territory contaminated by radionuclides. At such centers, local population can get information on radionuclides accumulation in different species of wild berries, mushrooms and wild industrial animals; citizens can get to know the allowable contamination level of the territory, where a definite non-wood product can be used; it will be possible to measure radiation contamination level in product samples and get information about the ways of these products' processing.

2. To work out information materials on non-wood forest production use in the conditions of radiation contamination. Based on the previous investigations, the ability to use non-wood resources depending on the density of soil radiation contamination will be determined in these recommendations.

3. To carry out trainings directed on the rise safety of the public living on the territories contaminated by radionuclides. The aim of educational activities is teaching local population to use non-wood forest products safely, depending on the level of the territory contamination by radionuclides. The trainings on the use of modern dosimetric equipment will be carried out.

Following groups of subjects concerned can be defined from the object:

1. Local population can get free consultation on the use of non-wood forest products on the territories contaminated by radionuclides; in this way, the internal irradiation doses can be reduced by limiting the penetration of radionuclides with food.

2. Considering recommendations worked out within the project, the organizations-suppliers can decrease the amount of berries, mushrooms and medicinal plants which have not passed radioecological control.

3. Thanks to qualified specialists and to modern radiological and dosimetric equipment of the information-consultative centers, pupils and students can broaden their knowledge on radionuclides migration in forest ecosystems.

The final beneficiary of the establishing information-consultative centers is a society as a whole, as far as the awareness of the population (especially youth) about safe use of non-wood forest production allows reducing the level of internal irradiation of local population. Thus, it will enable the formation of more healthy society on the territories contaminated by radionuclides.

Drozdov I., Khandogiy A.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

RESTRUCTURING OF THE BIRD RESERVE "LEBYAZHIY" UNDER ANTHROPOGENIC TRANSFORMATION

Environmental problems of the urban environment, disturbing millions of people today. In recent years, this concept includes not only nature, but also the urban environment (Dolbik, MS, 1974). The purpose of research - to assess the current impact of urban development on the avifauna of the reserve "Lebyazhiy". The scientific novelty of this work lies in the fact that for the first time in reserve "Lebyazhiy" was studied modern species composition and structure of bird population, distribution patterns on habitats depending on their properties and human activities with complex investigations.

The place of research was a republican reserve "Lebyazhiy". This is a unique, virtually transformed area located in the city of Minsk. Also, in recent years this reserve has increased the anthropogenic influence dramatically, and the strain with it.

Reserve "Lebyazhiy" is located in the floodplain area of the Svisloch River, in the south of Market "Lebyazhiy" and in the west of the reservoir «Drozdy». Natural, there are no areas free from human impact on the ecosystem adjacent to the reservoir. All of it more or less susceptible to mechanical stress (trampling, fireplace, fires, logging, etc.), or through environmental contamination by harmful substances in the air basin, soil or water (aided by road). Noticeable influence of a large city Minsk which only intensified in recent years (Khandogiy, 2005).

The material for the writing of this work served as research data for 2014–2016 years spent in the reserve "Lebyazhiy". The account number was performed using the routing method in the period of greatest activity of birds. Comparison of data from different years of observations was carried out with the help of statistical methods (the methods of descriptive statistics, Wilcoxon test).

Model species was carried out accounting for the analysis, divided into 4 categories, according to environmental groups: wetlands, open landscapes, synanthropic and forest. We have compared the total number of species in a particular ecological group, as well as changes in the number of model species in the period of 2014–2016 years.

The results showed (by Wilcoxon test), that between the data obtained in 2014, 2015 and 2016, there are statistically significant differences (for environmental groups: 2014–2015, $p = 0.0144128$, 2014–2016, $p = 0.0128455$; 2015–2016, $p = 0.0715001$; for the number of model types: 2014–2015, $p = 0.0379472$, 2014–2015, $p = 0.0068681$, 2015–2016, $p = 0.0084380$).

Thus, it was found that increasing the load on the human landscape reduces the number of different species of birds of various environmental groups. Also an in-

creasing number of anthropogenic species of birds is an additional threat to the rare and protected species.

Drozdov I., Luchina V.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ANALYSIS OF SURFACE WATER QUALITY IN THE CONTEXT OF ENVIRONMENTAL LAW OF THE REPUBLIC OF BELARUS

Nowadays Belarus has the problem of pollution of surface water nitrogen and phosphorus compounds, which are formed by the decomposition of organic substances. The compounds can get into water areas with domestic, industrial and agricultural effluents, as well as a result of fertilizer runoff from fields. According to the service of the National Environmental Monitoring Environmental control center environment, exceeding the standards for nitrogen and phosphorus compounds noted in 18% of samples of water of natural water bodies. It is fixed that in 2009 - 2010 in areas where fertilizer and pesticides used intensive, groundwater heavily polluted by nitrates, so drinking water from 11% of wells in rural areas is dangerous for consumption. In regions where water abstraction for the needs of the population is carried out with surface water, very high risk of contracting viral infections (such as from Vilejka reservoir.) Despite of infection diseases, toxic metals are found in surface waters as a result of the uncontrolled discharge into rivers and lakes industrial and agricultural wastes. In this connection, the concentration of heavy metals exceeds the permissible limits many times.

The most contaminated areas of rivers in Belarus Svisloch below Minsk, Gomel region in the Ouse, below Usha Molodechno, Zapadnaya Dvina in the Polotsk region, Novopolotsk and Verkhnedvinsk, Yaselda following Birch, Pripyat below Pinsk, the Zapadniy Bug at Brest and Mukhavets about Kobrin. It was found that out of the total volume discharged into the sewage waters, about 70% passed through water treatment plants, and the rest, regardless of value-added, into rivers and lakes without treatment. In addition, built 25–30 years ago, wastewater treatment plants, operating with outdated technology, based on the removal of wastewater easily oxidized organic matter and suspended solids. Those present in the effluent nutrients (nitrogen and phosphorus) with the help of these older buildings cannot be recycled. Therefore, a key focus of the protection of surface waters in the reservoirs of the country should be recognized as improving treatment technology of wastewater discharged while reducing their volumes. Without a radical reconstruction of existing and construction of new sewage treatment plants with denitrification and defosfatirovaniya technology, it is impossible to achieve the required level of wastewater treatment.

The solution to this problem lies in strict compliance with Articles 71,72, 84, 96, 98, 99 of the Water Code of the Republic of Belarus, including articles

272 and 273 of the Criminal Code, as well as in the implementation of the main directions of the Water strategy of Republic of Belarus for the period until 2020, approved by the Ministry of Natural Resources in 2011, contributes to the implementation of the program for the modernization of existing sewage treatment plants of large cities with the use of modern technologies remove organic pollutants and nutrients nitrogen and phosphorus compounds that improve the ecological status of open water bodies.

Ezerski A., Tushin N.

International Sakharov Environmental Institute
of Belarusian State University, Minsk, Republic of Belarus

MICRODOSIMETRY

In this report, I examine the basic principles associated with microdosimetry. If you wish to better understand the effects of radiation, the connection between some basic characteristics of the absorption of ionizing radiation in the matter with dimensions and, possibly, the nature of the structures, which are affected by this radiation should be taken into account. This is the purpose of microdosimetry.

The term microdosimetry came when Rossi et al. (Rossi, 1955a, 1959, 1960, 1968v, 1972) developed a conceptual approach and relevant experimental methods for systematic analysis of microscopic distribution of the absorbed energy in the irradiated material. They were identified and measured stochastic quantities such as the energy density of z, and the linear energy y. These values describe the energy transfer events in microscopic structures, such as small spherical volumes. These values and their distribution function are central concepts microdosimetry and over the past two decades with the help of their description was conducted a wide range of radiation phenomena. At the same time it was determined microdosimetry's other important concepts and quantities that allow complement the description of the spatial distribution of the energy transfer events.

Microdosimetry is branch of physics dealing with the study of transmission and distribution of energy of ionizing radiation in the matter at the cellular and subcellular levels.

The dosimetric quantities determining the radiation field and the interaction of radiation with the matter, such as the density of the energy flux density of the particle flux, radiation dose, kerma, and other is the macroscopic quantities.

A distinctive feature of macroscopic quantities is fairly smooth continuous change them when changing the parameters of the system, which they describe. For example, the radiation intensity is continuously varies with the thickness of the absorber, the dose of radiation with a change in the radiation flux density and so on.

Ionizing radiation, however, it is made up of discrete particles that transmit the energy of the matter in small, but the fixed portions. The interaction of radiation

with the matter of a statistical nature, and this leads to the fact that many physical factors, defining the dosimetric values are subject to random fluctuations.

These dosimetric quantities not describe microdosimetry system. The reason is that the concept of dose in its ordinary sense is only applicable to systems in which there is a sufficiently large number of events to fluctuations in individual acts of interaction didn't affect the value of a macroscopic quantity.

Development microdosimetry mainly determined by the needs of radiobiology, but its findings can be applied to any reaction of the irradiated material, depending on the microscopic distribution of energy.

The applied value of microdosimetry is determined by the ability of prediction and explanation of radiation effects in cases when these effects are caused by the defeat of sensitive microstructures such a small size that are significant fluctuations of the absorbed energy. For example, the genetic effects of radiation caused by the body's defeat of individual sections of the chromosomes that is carriers of heredity.

This discipline is in the active stage of development and continuous improvement. Research and development are carried out by the commission of the ICRP and ICRU.

Filippovich K., Prashko T.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ANALYSIS OF THE LARGE-TONNAGE WASTE HANDLING IN THE REPUBLIC OF BELARUS

We have reviewed the handling of the large-tonnage wastes in the Republic of Belarus for the period from 2005 to 2014. For this analysis we selected the wastes with the maximum amount of the waste production during the period of this study. According to the state statistical reporting in 2005 there were such wastes as hard halite waste phosphogypsum, and hydrolytic lignin. In 2014 the construction waste came in the third place.

The amount of accumulated and annually produced large-tonnage industrial wastes are estimated by millions of tons. Therefore, the problem of their use and recycling is extremely important. In Belarus, the total percentage of the large waste recycling has been amounted to 1.5% in recent years.

The greatest amounts of waste production in the Republic of Belarus are characterized by halite waste and clay-salt slimes of JSC "Belaruskali", which were accounted in 2014 for more than 62% of the annual output of waste production in the country. In 2005, the percentage of using halite wastes was 3.3%, but by 2014, the volume of waste production had increased by 4 million tons, therefore, the usage percentage had dropped to 2.2%. The traditional directions of waste utilization are manufacturing of the new forms of fertilizers and ameliorants for agriculture, construction materials additives, and drilling mud additives, as a mineralizer for the in-

tensification of the lime burning process and utilization as ice-melting composite. Making brines for soda production on the basis of these wastes, which started to be applied at the Berezniki chemical plant, is new and promising direction.

The assignment level of phosphogypsum was increased by 0.3% in comparison with 2005 and had been amounted only 0.8% by 2014. Phosphogypsum is used for the fertilizer manufacturing, feed additives and ameliorants. The use of phosphogypsum JSC "Belarusian cement plant" as a partial replacement of natural gypsum stone in supplements regulating the rejecting time is also promising direction. Traditional ways of using phosphogypsum are high strength gypsum composite materials; the composition of synthetic compounds based on krumnagel and phosphogypsum; using for road construction fosfodiesterasa bitumomineraljnykh composite materials; gypsum binder on the basis of phosphogypsum; carbide of calcium from phosphogypsum. The fill-up of additives from phosphogypsum printing paper in a mode of heterologously, the preparation of the new phosphate-based feed additives for animal industry, the use of phosphogypsum as a component of flame retardant polyurethane foam are new and promising.

In 2005, lignin was in third place in waste production terms. Nowadays, lignin is used as fuel and in 2014 it was not included in the list of large-capacity waste.

In 2014, the large construction waste came in the third place. In 2014, 7115,9 thousand tons of construction wastes were produced, 78% of which - the uncovering breed; 5% – mixed waste of construction, demolition of buildings and structures. The amount of waste production of the rest construction wastes does not exceed 17%. The index they use is very high – about 63.8% of the volume of waste production. The main direction is recycling of these wastes to large recycling companies, for example. PRUP "Crushed stone".

Gavdel A., Melnov S.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ANALYSIS OF ENVIRONMENTAL WASTE STATISTICS. BACKGROUND TO THE ELECTRONIC STATISTICAL REPORTING FORMS

Organization of industrial waste management system in the Republic of Belarus is one of the priority tasks in the field of ecology. To assess the effectiveness of action in this area, the development of the targets and taking strategic decisions in our country for more than 20 years, there is a form of state statistical reporting on waste. The statistical data transmitted on paper to the RUE "BRC" Ecology " today, employees of the organization carry out date further analysis and processing.

Database technology (DB) under the control of MS Access is now used for the processing and storage of statistical data

Creation of electronic forms of statistical reporting on the treatment of industrial waste (hereinafter – EF) with web-tools can become a shining example of the use modern information technologies in environmental protection activities.

EF is a client-server application and has a number of advantages:

1) collection of information takes much less time, thus reducing labor costs by making data in the database table;

2) validation (compliance) of input data on the client side (a nature-user) includes a comparison of data for several years, and completely eliminates the possibility of erroneous data in the database;

3) the amount of stored information is not particularly limited;

4) the use of GIS-technology provides more visual and complete information in territorial aspect;

5) there is a possibility of interaction between different information resources in the field of waste management and EF (eg, for the purpose of environmental agencies coordination).

To date, it solved a number of issues related to the creation of the EF:

1) an assessment and analysis of the information technologies used in environmental statistics, taking into account international experience;

2) the structure of the EF, the algorithm of its work and possible links with existing information resources used by environmental protection activities;

3) developed the design of the user interface of the system with a view to minimizing the user effort;

4) identified enablers ESP project.

The investigations as well as design of the system are carried out in the Republic Unitary Enterprise "Belarus Research Centre "Ecology". During the next a few years is planned to amend the regulations governing the issues of environment statistics, the implementation of the pilot version of the EF and its functional for the possibility of using EF as an alternative to existing technologies, the creation of new EF modules for a more visual representation of information using GIS-technology.

Gordiychuk V.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE CALCULATION MESH FOR HEAT TRANSFER COMPUTER SIMULATION IN PERMAFROST GROUND

Physical processes in soils are described by systems of nonlinear differential equations in partial derivatives, supplemented by the boundary conditions. In the models describing the physical processes in frozen soils should consider water-ice phase changes and dynamic phase transition boundaries. This is why the calculation

grids should satisfy the special requirements. On the one hand, it should provide a sufficient accuracy of calculations. So, the grids for the models with complicated boundaries are constructing using irregular spatial steps and mesh refinement in the featured areas. On the other hand, this increases the calculation time and requires more computational resources.

Today, the world leaders in the field of computer (mathematical) modeling are usually using the finite element mesh. Finite element mesh has several advantages:

1) Universality; the finite element method can be used to solve various problems: heat transfer simulation, mechanical problem, fluid dynamics, etc. This makes a comprehensive analysis possible;

2) Higher boundary approximation accuracy;

3) Deformability; in solving the mechanical problem (and some others) it is important to have the ability to change the calculation mesh considering results of the current iteration. Deformability helps to track the dynamic boundaries.

However, the approximation based on the finite difference method also has a number of advantages:

1) simplicity of software implementation;

2) high computational performance (per node);

3) easy parallel computing (including SIMD architectures).

In this paper we propose the finite-difference calculation mesh for simulation of heat transfer processes occurring in permafrost soils. The estimations showed that for qualitative sampling of soil reference sample area of 1 hectare and a depth of 10 m is required grid consisting of more than 1 million units. The prediction calculation of the thermal conductivity of the soil for 10 years on a grid takes about 10 minutes on a single CPU core.

For modeling of processes taking into account a filtration within the classical Darcy's law is offered the fixed settlement grid based on fictitious areas method. However, the counting duration even for a test example considerably increases.

Gorskaya V., Boyarkin O.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

CONTROLLED THERMONUCLEAR FUSION

In our work achievements and perspectives aimed to producing controlled thermonuclear reactions of fusion are considered. We remind that fusion is the energy source of the Sun and stars. In the tremendous heat and gravity at the core of these stellar bodies, hydrogen nuclei collide, fuse into heavier helium atoms and release tremendous amounts of energy in the process. As a rule in terrestrial laboratories the following reactions

$D + T \rightarrow {}^{4}He + \mathrm{N}$, $D + D \rightarrow {}^{3}He + \mathrm{N}$, $D + {}^{3}He \rightarrow {}^{4}He + {}^{1}p$

are investigated as the starting point. In so doing heating and confinement of magnetic field plasma is carried out at relatively low pressure and high temperature. To achieve that the thermonuclear reactors in the form of either tokamaks (toroidal chamber with magnetic coils) or stellarators are used. In both setups the plasma is confined by the magnetic field, but the magnetic field in a tokamak has the shape of a toroidal cord through which electrical current is passed, while in stellarator magnetic field is induced by external coils. The latter is the main difference of the stellarator from the tokamak and that causes a complex configuration of the magnetic field in the stellarator.

The international project ITER (the way – in Latin) is one of the most ambitious energy projects for producing controlled thermonuclear fusion. The idea of the project is to build the world's largest tokamak, that will realize the controlled reaction of fusion at a large-scale for long periods of time, and also use a carbon-free as a source of energy. The ITER will be the first fusion device to test the existing technologies, materials, and physics regimes necessary for the commercial production of fusion-based electricity. The main objectives of the ITER are as follows:

1) to achieve the fusion power of the order of magnitude of 500 MW (the world record for fusion power was held by the European tokamak JET – 16 MW of fusion power);

2) to demonstrate the integrated operation of technologies for a fusion power plant (ITER will bridge the gap between today's smaller-scale experimental fusion devices and the demonstration fusion power plants of the future);

3) to create a deuterium-tritium plasma in which the reaction is sustained through internal heating (fusion research today is at the threshold of exploring a "burning plasma" – one in which the heat from the fusion reaction is confined within the plasma efficiently enough for the reaction to be sustained for a long duration);

4) to test tritium breeding (the world supply of tritium is not sufficient to cover the needs of future power plants and ITER will provide a unique opportunity to test mockup in-vessel tritium breeding blankets in a real fusion environment);

5) to indicate the safety characteristics of a fusion device (one of the primary goals of ITER operation is to demonstrate the control of the plasma and the fusion reactions with negligible consequences to the environment).

The stellarators Wendelstein 7 is the project competing as compared to the ITER. We give basic characteristics of this stellarator and make the final decisions about the contemporary status of the problem concerning the controlled thermonuclear fusion.

Halaukova T.[1, 2], Zhyvitskaya A.[1],
Matchekhin A.[2], Solovyov V.[2], Gritsai N.[1]
[1]*International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;*
[2]*IHC "Mogilev Regional Centre for Hygiene, Epidemiology and Public Health", Mogilev, Republic of Belarus*

RETROSPECTIVE ANALYSIS OF AIR POLLUTION IN THE CITY OF MOGILEV WITHIN THE PERIOD OF 2005–2014

Environmental pollution, especially air, industrial emissions, and motor vehicles causes growing concern in many countries in recent years. The main problems associated with air pollution relate to the harmful effects on health. According to the World Health Organization, air pollution is the single and the most important factor in environmental risk to health in European Region.

The sources of air pollution of the city of Mogilev are the enterprises of thermal energy, chemical industry, iron and steel industry, housing and communal services and road transport, which account for over 75% of emitted pollutants. Enterprises are located in different areas of the city and constitute compact industrial zones. The location of many enterprises on hill sites on the windward side towards the residential areas and the city center leads to an increase in the impact of emissions on the population.

The purpose of the research is to give hygienic characteristics of the environment and to assess the potential impact on public health of Mogilev.

The concentrations of main pollutants (accumulated particulate pollutants, sulfur dioxide, carbon monoxide, nitrogen oxide and dioxide), as well as prioritized and specific ones (formaldehyde, ammonia, phenol, hydrogen sulfide, carbon disulfide, and methanol) are identified in the atmosphere of the city. The retrospective analysis of air pollution for the period 2005–2014 by the substances such as formaldehyde, nitrogen dioxide, carbon disulfide, phenol, carbon monoxide, particulate matters, ammonia, and hydrogen sulfide was carried out in the work.

Thus, over the study period in the city of Mogilev the average annual concentrations of basic and specific pollutants remained at a sustainable low level and were below the hygienic standards. According to stationary observations of the whole city over the study period, only the average annual concentrations of phenol and carbon oxide slightly decreased. The levels of hydrogen sulfide and carbon disulfide pollution remain consistently low. Also the average annual concentrations of nitrogen dioxide and ammonia are at a sustainable and low level.

On the basis of the available data, the value of the complex index "P" was calculated, and the hygienic assessment of the air pollution degree was carried out. The total level of Mogilev atmosphere pollution was recorded within 1,152–1,879 conventional units, and it is rated as «admissible» (degree 1 of air pollution).

In accordance with population health gradation to the acceptable level of air pollution, the background incidence level corresponds to such grading of population health as «adaptation».

Handohiy I.

Belarusian State University, Minsk, Republic of Belarus

PAINT POLIMORPHISM OF DOVE BLUSH IN MINSK

One of the most actual environmental issues is to identify the characteristics that contribute to the adaptation of certain species to anthropogenic territories. In this regard, a favorite object can be dove gray, synanthropic species, part of the population of which has lost the ability to exist outside man-made landscapes.

The purpose of research is to study the ecology of the rock-pigeon and its adaptive capacity to the conditions of the urban environment.The material was collected in the Frunze and Moscow district of Minsk from April to October 2016 Accounting and surveillance were carried out in places of bluish clusters of pigeons in the daytime. The paper used the method of allocation of painting morphs pigeons described in Vanichevoy LK (1997). Painting morphs were determined in 4803 specimens, based on the results processed by the usual method (Lakin, 1980).

It is well known that in nature morph is common for paint polymorphism of rock pigeon (Moskvitin, Ksents, 1982).

These personal data on polymorphism of rock pigeon in the urban environment in Minsk revealed significant differences in the frequencies of phenotypes between painting pigeons on all the 11 hospitals. Analysis of this material of paint polymorphism showed that the dominants are black and engraved morphs – 62.1±17.8, while the proportion of blue-gray doves is 22.3±13.9 (Khandogiy, 2016). Aberrants are outsiders. Their percentage of the other morphs varies from 15.6±3.4%. These differences in these administrative areas are insignificant, indicating that due to the relatively high mobility of pigeons the genetic exchange is provided between the groups of pigeons from different parts of the city.

As in Belarus, in the major cities of neighboring countries and all over the pace, the black and chased is the dominant morph of paint polymorphism : the Russian Federation - from 46 to 83% (Moskvitin, Ksents 1982, Salimov 2008, Losev, 2011, Likhachev, Romanov, 2015) Bashkortostan – 91–95% (Salimov, 2008), Udmurtia – 90–95% (Salimov, 2008), Moldova 39% (Moskvitin, Ksents, 1982), Turkmenistan – 33% (Moskvitin, Ksents, 1982). In these regions ,the blue-gray morph as the original form is ranging from 2 to 42%. All other morphs - brown, speckled, and melanistic range from 0% (Votkinsk, Udmurtia) to 47% (Chisinau, Moldova) (Moskvitin, Ksents, 1982).

Thus, in urban areas of Minsk in local groups of rock-pigeon synanthropic identified 5 main color morphs, of which 62.1% are black and embossed color morphs, 22.3% – to the white and 15.6% – to aberrants (brown, speckled, and mel-

anistic). A comparison of the number of individuals and the number of morphs in each color band revealed the presence of a moderate direct relation between these parameters ($r = 0,37$; $p = 0,005$). The variability of morph frequencies is determined by the influence of the number of blue-gray doves in the area, as well as other factors related to the environment and trophism of the species.

Hatskevich A., Ryshkel I.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

AIR POLLUTION ASSESSMENT OF PERVOMAISKY AND PERTIZANSKY DISTRICTS OF MINSK USING LICHENS AS BIOINDICATORS

Vegetation as a component of environment takes part in the maintaining of both biosphere and separate ecosystems balance by its close interaction with water, air and soil. The most important indicator of the state of the environment is the gas composition of atmospheric air, which determines the living conditions of people and all living organisms. Anthropogenic activity growth significantly changes chemical, physical, mechanical and biological parameters of air environment.

Lichens react to air pollution in a different way: some of them cannot bear even the slightest contamination and die, whereas others grow only in cities and other urban areas well adapted to corresponding anthropogenic conditions. Possessing this quality lichens can be used for general environmental pollution assessment and especially for air pollution assessment. There are plenty of biological methods of air contamination assessment. One of the most important is lichen bioindication method.

This method uses trees as a substrate. The most widespread tree species on the research territory is chosen for assessing atmospheric pollution of cities, regional centers and villages. A wooden frame (10x10 cm) determines sample area. Lichen species seen in the sample area are identified, each species proportion of the sample total area is calculated.

The research included the study of Minsk atmospheric environment conditions. Two regions with chosen sample areas for lichen bioindication method research were selected.

Within the framework of practical research, we can draw a conclusion that lichens are ecological atmosphere indicators. The result of research on Minsk atmospheric pollution using lichen bioindication method showed that the general state of air environment is satisfactory, but Pervomaisky region has ecological advantage as compared to Partizansky region. The level of urban greening, landpark areas size, transport exhaust fumes and industrial plants emissions influenced the research results.

Holdman E., Tyshin N.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE EFFECTS OF LOW DOSE RADIATION. RADIATION HORMESIS

Currently, there is no consensus about the influence of low doses of ionizing radiation on the body. Some researchers believe that low doses cause positive effects, also known as the hormesis effect. Others say about the dual nature of exposure with low doses. Accordingly, there are two opposing models for assessing effects of ionising radiation on the organism. The first one is the linear no-threshold model, which is based on the assumption that any dose of radiation is harmful. The second one is the threshold model. It postulates that there is a threshold dose below which radiation cannot cause diseases carcinogenic and non-carcinogenic nature. This model relies on the concept of radiation hormesis.The concept of "radiation hormesis" suggests, that ionizing radiation in low doses can induce positive biological effects and to provide a stimulating effect on the organism.

According to the last model of low doses impact, we can characterize effects of low doses not as a positive effect (or hormesis effect), but as a hyperfunctional effect. That means that small doses can result in both positive and negative effects, which are a deviation from the norm.

The effect of low doses of radiation on the body causes damage to DNA with the launch of the reparative systems. Also the stimulation of physiological processes, which neutralize damage to DNA, starts. However, the systems of DNA repair are not specific and are aimed at the neutralization of non-radiation DNA damage.

Any increase of ionizing radiation effect intensity leads to increase of the risk of mutations. Sometimes a cell goes through mitosis without eliminating radiation-induced damage. In this case, there may be a process of such rapid multiplication of clones of mutated cells. The result of this process is the formation of a tumor.

In view of the utmost importance of this problem, there are many studies on effects of low doses on the organism. Experiments were conducted on animals.

For example, experiment on x-ray irradiation of mice throughout life conducted in 1950 and 2005, experiment on infection of mice with Salmonella typhimurium a day after x-irradiation in 1953, study of the effect of gamma radiation onmice life expectancy in 1958 and 2002.

There have also been studies of the effect of low doses on humans as a result of their professional activities or emergency situations or natural sources.

For example, comparison of the mortality rates from cancer in the highlands (765 mSv/year) and in areas of lowlands (195 mSv/year), 1998, USA; study of the beneficial effect of chronically high exposure among women older than 35 years, 1990, China; a study of the influence of chronic irradiation as a result of the incident in Taiwan, 1982-1983.As well as a series of studies of the life expectancy and

quality of life of NPP workers, military personnel who participated in nuclear weapons tests, radiologists, etc.

All studies in this field are very contradictory. Therefore, the influence of low doses in general, and the effect of hormesis in particular, need additional study.

Ilkevich V., Pazniak S.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE ANALYSIS OF VOLUMES OF THE FOOD INDUSTRY WASTES

Food waste pollute vast areas of land. Almost all enterprises of the food industry emit gases and dust, worsening air condition and lead to an increase in the greenhouse effect and of course have a negative impact on water resources. Daily millions of people throw away remnants of food, tainted products, packages, glass and plastic bottles, and much more. All this accumulates and requires ongoing processing and disposal, but because of the large volumes of waste, lack of high-tech equipment, these operations may be slow.

The aim of our research is to analyze volumes of the food industry waste generation and the creation of innovative technologies for the use of various wastes as alternative energy sources.

The object of analysis is the city of Smorgon and its industries. Defining activities in the industry is the production of wood products and paper (56.8%), production of food products, beverages (24.6%), manufacture of machinery and equipment (10.5%), electricity supply, gas, steam and water supply (3.1%). The largest enterprises of food industry are "Smorgon Dairy" the branch of OJSC "Lida Milk Plant", UPE "Smorgon plant of bread production" and numerous catering facilities. On the territory of the Smorgon and Smorgon district landfill SMW "Black Forest" is located and 23 mini-sites are located. During the research such concepts as "food industry" were examined, its basic industries were named, environmental problems were characterized that are related to food production and analysis of the volumes of waste food generation was carried out.

Kalmykova O.

Odessa State Environmental University, Odessa, Ukraine

HORMESIS WITH THE AID OF DYNAMIC SYSTEMS

The term "hormesis" introduced S. Zontman and D. Ehrlich in 1943, comes from the Greek hórmēsis (fast movement, aspiration) and is the stimulating effect of moderate doses of stressors. To indicate the positive effect of low doses

of ionizing radiation, the term radiation hormesis, which was proposed in 1980 by Lucky T. [1].

In this paper we discuss the proposed O. Gerasymov use of certain provisions of the theory of dynamical systems, in particular - of stochastic resonance, as hormesis concept.

The International Commission on Radiological Protection has formed a concept about the linear no-threshold dependence of the probability of stochastic effects the dose. Formation of the concept is derived from the hypothesis that the harmful effects of ionizing radiation on the cell causes changes that could develop into a mutation at any arbitrarily small dose.

United Nations Scientific Committee on the Effects of Atomic Radiation to the data on the positive effects of low doses of ionizing radiation in fact casts doubt on the idea of the linear no-threshold harmful effects of radiation at low doses and cause arguments about the need to replace this paradigm [2].

Existing probabilistic approach does not carry any evidence.

It is concluded that the proposed O. Gerasymov approach differs from the no-threshold or probabilistic approaches and opens the way for an alternative parameterization of the phenomenological framework of hormesis.

The absence of sufficient data, is strictly addressed to the phenomenon of dose-effect needed to clarify the parameters of the influencing factors, hampers proper parameterization data on radiation hormesis in any of the proposed approaches. The task of forming accurate phenomenological database is a separate problem.

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Kaluhina T., Ikonikova N.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE STUDY OF THE BIOLOGICAL PROPERTIES OF MELANIN PIGMENTS OF BASIDIOMYCETES IN ARTIFICIAL CULTURE

Melanins represent a numerous and intensively studied class of natural polyphenolic pigments. Melanin’s pigments detect in living organisms on all evolutionary levels.

The research of physical and chemical, biological properties the melanin’s pigments of the mushrooms received in the conditions of deep cultivation, definition of their type and predecessors, studying of a possibility of practical use as medical and treatment-and-prophylactic medicines.

The purpose of this study is to study the physico-chemical and biological properties of melanin's pigments.

To achieve this goal the following tasks were assigned:

• research of accumulation of pigments of phenolic nature from collection strains of basidiomycetes on agar;

• research of antioxidant, genoprotective properties and the sorption capacity of melanin and biomass of fungi containing melanin .

Methodological basis of research is scientific works of domestic and foreign scientists in the field of study and research of biological properties of melanin pigments. As methods of research were used private biological methods.

Has been revealed high genoprotektive and antioxidantion activities the melanin's pigments from a deep mycelium the bazidiomycetes. It is established that melanins from Ph. robustus M-10 and I. obliquus V-26 in concentration respectively 10 and 20 mkg/ml total prevent DNA damages the phaga λ with products of peroksidaze oxidation of aminobiphenyls. Melanin's of basidiomycetes in concentration of 200 mkg/ml of a melanina for 75–80% inhibit reaction of peroksidaze oxidation of a dianizidin. Genoprotektective activity of Ph melanin. robustus M-10 is twice higher than at a pigment of I. obliquus of V-26.

It is shown that a deep mycelium and melanin's pigments of mushrooms of Ph. robustus M-10 and I. obliquus V-26 have high sorption ability in relation to ions of lead, copper, zinc, nickel. Effective sorption of ions of heavy metals is carried out in the range of temperatures of 15–30 °C (with a maximum at 25 °C) at pH environments 6,0. It is revealed that a deep mycelium and melanin Ph. robustus M-10 have high affinity to lead, one of the most widespread and people of pollutant hazardous to health. Sorption capacity of melanin Ph. robustus M-10 concerning the tested metals considerably (by 1,3–1,4 times) surpasses that of V-26 I. obliquus melanin.

Karmilitsyna A.[1], Zhyvitskaya A.[1], Arachou A.[2], Levdanskaya N.[1]

[1] International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;

[2]State Institution Lida Zone Center of Hygiene and Epidemiology, Lida, Republic of Belarus

ANALYSIS OF THE REPRODUCTIVE HEALTH OF THE POPULATUION OF GRODNO REGION IN 2006–2014

Reproductive health is an important factor which generates favourable demographic prospects of the country.Now the decrease of reproductive health reserves, deterioration of all parts of the reproductive cycle such as conception, pregnancy, formation of a complete family, the quality of children's health are being observed. Therefore the problems associated with health in general and reproductive health in particular are of special relevance in modern society.

The research aims to analyze the dynamics and the identification of the main trends of indicators characterizing the reproductive health of the population of Grodno region in 2006–2014.

Based on the collected data characterizing the reproductive health of the population of Grodno region for the period from 2006 to 2014 extensive and intensive indicators, birth rate growth, long-term trends were calculated using the method of least squares.

Based on the analysis of the figures obtained we can draw the following conclusions:

- Over the period of research there is an increase in the birth rate in the population from 10.0 to 12.6 per 1,000 people. And the birth rate in the urban population is higher than in the rural one and it is 13.3 and 10.5 per 1,000 people respectively up to the end of the period of research;
- There is a decrease in the birth of premature infants. In 2006 the figure was 3.4% of the number of births, it decreased to 2.8% in 2014;
- The number of stillbirths reduced from 0.27% to 0.2% of the number of live births and stillbirths;
- There is a decrease in the number of abortions. At the beginning of the period of research the figure was 4,200, at the end of the research it decreased to 2,800;
- There is a dramatic decline in maternal mortality from 18.2 deaths per 100 thousand live births in 2006 to its complete absence from 2008 to the end of the analyzed period;
- The number of infant deaths has also been reduced. In 2006 the figure was 1.0 per 1,000 live births and in 2014 it was 0.8 per 1,000 live births. However mortality rates in premature infants are still relatively high.

In the light of the foregoing in the current circumstances the structure of the family planning service should be improved and supplemented with the development of reproductive health care and related services.

Kasach Y., Handogy A.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE ROOTING ACTIVITY OF TALPA EUROPEA IN POPULATED AREAS OF PUHOVICHI REGION

The modern aims of using nature resources of commercial mammals strongly demand the clear undestanding about the main ecological features of different species. The talpa is essential in fur-trade being the prominent commercial species (Savitky and others, 2005). The biocentric role of talpa is very prominent and varied. All the above reflects the thematic justification, the aim of which is the studying of the talpa's ecological features in conditions of Puhovichi region.

The results of field research, which was made in summer 2015 and 2016 by us. Park and three populated locality were taken as the pattern of habitat.

The finding of the biotopical distribution of talpa was determined by standard methods (lasukov, 2014).

During the land evaluation we took into account such features as soil quality, protective conditions, ground features and composition of vegetation (Rusakov, 1965).

The analysis of the received materials showed that molehills located irregularly, which allowed us to mark it as the ordinary lands of living. In these conditions soils are mesopodzol and telopodzol, sabulous, loamy, tight. According to the biomass of worms food reserve is poor. A number of living passages are less than five per one kilometer. The most highest density of molehills was noticed in section № 2, where the soil is stiffish enough, in comperison with section № 7 which has friable soil. It points to the fact that the friability of the soils is not the main factor for the distribution of molehills.

In the inhabited localities with different population (250, 140 and 67 households, respectively) soils are turfy-modal podzol, mezopodzol, sabulous and loamy, wet, less fresh. For talpas the food supply is good. In the sample area there were about 90 earthworms, 63 insects. The total biomass of invertebrates is 45gr. The number of residential transitions is not less than 15 per 1 kilometer. All the interviewed residents noted the increasing of talpas' activity every year.

An attempt was made to study the correlation between the amount of precipitation, air temperature, by the moisture supply in summer and the environmental parameters of populations.

The relative amount of young in captured samples in summer depends mainly on the intensity of parturiating (g = +0, 73). The weather conditions of summer period have less significant impact on the safety of the young. The dependence of the survival of underyearlings from the monthly average temperature of summer period is moderate (g = +0.28), but slightly higher than the moisture from the soil. Excessive moistening has a negative effect on the young (g = +0, 47).

Thus, for the entire period of researches in general for the whole population of talpas the preferred habitats have been distributed as follows (in descending order): park, small populated areas and large populated localities.

Kavaliova V., Tushin N.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

SAFETY BARRIERS IN THE PROJECT "NPP–2006"

Republic of Belarus, is interested in the safety and reliability of nuclear power plant in Belarus because it is one of the countries which are more affected by the accident at the Chernobyl nuclear power plant. That is why, before settling on

a specific choice of the project of the future Belarusian nuclear power plant, scientists and specialists of the Republic a thorough analysis and evaluation offered in the world market of modern projects of new generation nuclear power plants and companies for their implementation. In the end, for implementation in the Republic of Belarus is the Russian project of generation "three plus" "NPP-2006" with increased reliability and security, focusing on the advantages and remedy the shortcomings of previous Russian designs of NPPs. The project "NPP-2006" includes the construction of two WWER-1200.

The project "NPP-2006" the strictest international standards and recommendations of the International atomic energy Agency, is distinguished by improved safety characteristics and improved technical and economic indicators. For some of these indicators, the project exceeds the foreign analogues. The features of this project is the use of additional passive safety systems combined with traditional active systems; protection from earthquake, tsunami, hurricane, falling aircraft; double protective shell of the reactor hall; "the trap" of core melt located under the reactor vessel; passive system for removal of residual heat, increase of service life of power unit to 60 years; increase in the lifetime of a nuclear reactor due to the tightening of the requirements for the chemical composition of the steel in order to reduce the critical temperature of embrittlement; the increased diameter of the reactor vessel and the number of sets of surveillance specimens, which tracks the current state and defining forward-looking assessment of changes in the properties of the metal casing.

The security system of the modern Russian NPP consists of four barriers in the way of spreading ionizing radiations and radioactive substances in the environment. The first is the fuel matrix, to prevent release of fission products under the cladding of the fuel element. Second – the shell of the fuel element, preventing the fission products get into the coolant main circulation circuit. Third, the main circulation loop, which prevents the release of fission products under a protective sealed envelope. Finally, the fourth is a system of sealed protective shell (containment), eliminating the release of fission products into the environment. If something happens in the reactor hall, all radioactivity will remain inside this shell.

All Russian modern nuclear WWER-type reactors have containment. The shell is designed not only to external stimuli – for example, aircraft crash, tornado, hurricane, or explosion. The containment can withstand an internal pressure of 5 kg/cm^2 and the external impact from the shock wave, creating a pressure of 30 kPa, and the incident plane weighing 5 tons. That is, if you assume that all served in the reactor water turns into steam and, as in the giant kettle, will put pressure on the inside of the lid, the shell will withstand this enormous pressure. Thus, the dome of the unit is as if in constant readiness to take a punch on the inside. To do this, the shell is made of "prestressed concrete": steel ropes, tight inside the concrete shell, give an additional solidity of the structure, increasing its resistance.

The use of these systems allows you to protect nuclear power plants against the effects of natural and technogenic character, and also incorrect actions of personnel in emergency situations.

Khokh A.[1], Kuzmenkov D.[2]

[1] International Sakharov Environmental Institute of Belarusian State University; Minsk, Republic of Belarus;

[2]Scientific and Practical Centre of the State Committee of Forensic Expertises, Minsk, Republic of Belarus

CREATION OF THE AUTOMATED WORKPLACE "DENDROEXP" ON PROCESSING OF DENDROCHRONOLOGICAL INFORMATION

The issues involved in the detection and analysis of tree layers are not unique to the application, but are likely of interest to anyone developing automated image analysis systems.

At present, tree layers are becoming increasingly critical for understanding the nature of past environmental variability, and how it may change in the future. They are frequently analyzed by foresters, forensic experts, ecologists and botanists. The purpose of the analysis is usually to evaluate the growth of trees or their growth patterns. Growth patterns are analyzed to determine trends in the climate by using the inverse relationship of growth to climate. To date, extracting information from these is consuming and tedious task. Many hours of tedious work by experts in dendrochronology are required to accurately analyze each tree ring sample. This applies even when sophisticated detectors are used to make basic measurements, since great care must be taken in stringing series of measurements together into very long time series whilst retaining all information that might turn out to be useful later in the analysis. Existing image-analysis software alone cannot solve this problem. The labor-intensive analysis that these records require has created a strong incentive to develop instrumentation that can be used to process samples more efficiently, and with more interpretive power than is available from off-the- shelf image processing software. So, development automated workplace (AW) for dendrochronological information processing was very relevant.

The automated workplace "DendroExp" was created by the Scientific and Practical Center of Forensic Expertise of the Committee State of the Republic of Belarus to accurately and efficiently measure of tree layers. An image analysis system for measuring is required if large numbers of wood samples are to be analyzed efficiently. AW "DendroExp" is based in recent advances in dendrocomputer technology and consists of two parts:

1) server part that stores information in the Sybase Adaptive Server Anywhere 9.0;

2) client part that implement a number of key functions:

a) entering accompanying information;

b) digital image processing of wood samples and improving their properties (filtering, enhancement, contrast, brightness, inversion, etc.);

c) automatically detecting of tree layers (in addition to ring widths, other features such as early wood and late wood can also be measured and recorded);

It has been shown that accurate representations of tree layer boundaries can be created with a high degree of accuracy. But in many cases, it is still desirable to retain the option of specialist intervention during the process.

d) cross-dating of time series (for verification of series and the elimination of possible errors and to find the correct dated position in time).

e) statistical data processing (t-statistic for correlation significance and a special tools for cross-dating of tree-ring series);

f) various visualization of the results;

g) building various specialized and personalized data bank for analysis which contain tree layer data as well as their documentation and spatial information.

In summary, a prototype of the automated workplace for dendrochronological information processing has been developed. It is useful tool for dendrochronological investigations. The time spent calculating the width of a tree layer using AW "DendroExp" is significantly less than the time required by the manual measurement.

Khokh A.[1], Rubinchik S.[2], Kuzmenkov D.[2]

[1]International Sakharov Environmental Institute of Belarusian State University; Minsk, Republic of Belarus;

[2]Scientific and Practical Centre of the State Committee of Forensic Expertises, Minsk, Republic of Belarus

RADIAL GROWTH OF SCOTS PINE ON SOILS OF INSUFFICIENT, MODERATE AND HIGH MOISTENING

Tree growth can be influenced by a wide-variety of abiotic and biotic factors. Certain factors influencing tree growth may be very local in effect. It is well established that local soil condition determine growth of forest ecosystems. The width of a tree layer shows the amount of growth that has taken place during one year and thus indicates the growing conditions for that year. When the conditions are good the tree grows faster and so lays down more tissue in the year, resulting in a wider growth layer. Poor conditions mean slower growth, less tissue laid down and consequently a narrower layer.

The purpose of our research was to reveal laws of formation of pine radial-growth in contrast forest types on soils of insufficient, moderate and high moistening and factors determining this process. The objects of the research were pine trees of the Berezinsky biosphere reserve. The trees we used as samples are relatively old trees, 95–150 years old, 16–27 meters high. Wood samples

were taken in six plots. Forest types are *Pinelum cladditiosuinm* (chronology № 1), *Pinetum pieridiosum* (chronology № 2), *Pinetum oxalidosum* (chronology № 3), *Pinetum polytrichosum* (chronology № 4), *Pinetum ledosum* (chronology № 5) and *Pinetum sphagnosum* (chronology № 6). Two cores were taken from 20 pine trees in each plot. The annual layers width was measured with LINTAB 6 measuring system to the nearest 0,01 mm. The tree-ring series were cross-dated and standardized by using the corresponding software TSAP-Win Scientific (Rinn 2003).

Our results show that all tree-ring chronologies (TRC) have high interserial of coefficients correlation/correlation between individual series (0,67–0,74) that speaks about existence of well-expressed external factors which are revealed similar dynamics of an annual increment of all trees. Since the trees are of the same species and all grew under similar conditions the tree layers are expected to be the same distance apart in the same year.

Moreover, all TRC have high coefficient of sensitivity. The sensitivity of №5 and №6 tree-ring chronologies is a bit higher than № 1–4 chronologies. It is explained that two first chronologies are formed in extreme conditions on the soil by high moistening.

All tree-ring chronologies except № 1–2 have high autocorrelation of first order. A high autocorrelation shows that increment of pine trees is connected with variability of the external factors. A small coefficient of the autocorrelation of first order in № 1–2 chronologies is connected with impact of other internal factors which cause long stable decrease or increase of increment.

Correlation between chronologies is decreased with growth of distance between them in the soil moisture time series. A high correlation is observed between the trees in the plot № 1 and № 2, communication – in the soil and groundwater conditions. A sufficient positive correlation coefficient is observed for № 4 and № 5 chronologies. Correlation between № 1 (*Pinelum cladditiosuinm*) and № 6 (*Pinetum sphagnosum*) chronologies totally absent.

Analysis of the negative pointer years showed that unfavorable years for tree growth were: 1914, 1940, 1971 and 1979 for *Pinelum cladditiosuinm*, *Pinetum pieridiosum* and *Pinetum oxalidosum;* 1914, 1917, 1947, 1979 and 1993 for *Pinetum polytrichosum*, *Pinetum ledosum;* 1925, 1930, 1934, 1957 and 1971 for *Pinetum sphagnosum.*

Thus, results showed that each forest type is different from other in amplitude and nature of the variability of the width of tree layers. The most sensitive to external influences are sphagnum pine forests. These results may therefore be valuable for the forensic expert practice to establish tospecify terrain and tree site conditions and to identify the terrain compartment where the analyzed trees have grown.

Kolchenko N., Kundas S.
Belarusian National Technical University, Minsk, Republic of Belarus

WASTE RECYCLING AND USING IN ENERGY PURPOSES

The consumption habits of modern consumer lifestyles are causing a huge worldwide waste problem. Having overfilled local landfill capacities, many first world nations are now exporting their refuse to third world countries. This is having a devastating impact on ecosystems and cultures throughout the world. Some alternative energy companies are developing new ways to recycle waste by generating electricity from landfill waste and pollution.

Belarus generates around 30 million tonnes of waste annually, out of which household waste makes up 3 million tonnes. Each year, the volume grows by 20%. Existing waste recycling stations have the capacity to recycle only 12% of household waste, while in the EU the rate of waste recycling is around 60%.

The rest is dumped into landfills and/or buried. The existing landfills in Belarus often do not satisfy the basic standards in their way they carry out their operations or with regards to their location or their usage. These landfills pose a major threat to the environment in Belarus.

Although the government states that 85% of urban housing has access to separate waste systems, the population does not yet actively use it. As a result, the waste suitable for recycling makes up half of the total waste and ends up in landfills.

The absence of equipment for recycling various post-consumer waste constitutes another problem, as the state has no resources to invest in this area.

Several foreign investors have already established their business in this area in Belarus, such as the Swiss company TDF Ecotech AG, the Swedish company Vireo Energy, Austria's Strabag and the German company Remondis. However, they work only in several urban centres, while most towns, the those that are small or medium-sized, have no prospects for developing a sustainable waste management system.

This year was put into operation a factory near Grodno, which is the third such facility in our country. This factory will dispose of 100% waste generated in Grodno and in part in the regional center of the area. Investment in this project is approximately $ 28 million, the power is about 120 thousand tons of waste per year.

In Belarus in 2020 is scheduled to begin construction of 14 waste sorting factories. The rest of the waste sorting factories will be built in major cities across the country. Also Belarus actively searches for investors for the construction of enterprises for sorting waste in Vitebsk, Minsk, Borisov, Orsha, Bobruisk.

The cost of construction enterprises for the processing of waste depends on the technology. Creating a simple sorting worth 10 million euros to 100 thousand tonnes, and burning of waste – 100 million euros. This is due to the cost of equipment, the cost of cleaning system from waste incineration. Good example of such factory is the Spittelau waste incineration plant, which located in Vienna, Austria.

It processes around 250,000 tonnes of household waste every year. The plant in the 9th district produces approximately: 40,000 MWh of electricity; 470,000 MWh of district heating; 6,000 tonnes of scrap iron; 60,000 tonnes of clinker, ash and filter cake. The environmentally friendly heating produced at Spittelau is enough to heat more than 60,000 households in Vienna in a year.

In Belarus this direction of waste utilization is not used, because it is very expensive in terms of construction and operation. One way to involve this very promising for energy sector and environment technology – looking for external investment with state supporting of it.

Komar D.[1], Kutsen S.[2]

[1] International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;

[2]Research Institute for Nuclear Problems of Belarusian State University, Minsk, Republic of Belarus

NEUTRON CAPTURE GAMMA RAY FIELD WITH ENERGY TO 10 MEV FROM RADIONUCLIDE FAST NEUTRON SOURCE

Wide spread and use of technogenic sources of ionizing radiation such as particle accelerators and nuclear reactors leads to appearance of a number of applied metrological tasks aimed at providing spectrometric and dosimetry ionization measurement instruments, located for photon radiation fields with energy to 10 MeV.

Gamma rays with energy higher 3 MeV may be acquired using radiative thermal neutron capture on target, i.e. (n, γ) – nuclear reaction. In range of energies to 7 MeV Titanium is used; to 10 MeV – Nickel. Simplest source of instantaneous Neutron Capture Gamma-Ray should consist of fast neutron source, neutron moderator and target irradiated with thermal neutrons. As a source of gamma-ray with energy to 10 MeV thermal neutron collimator of AT140 Neutron Calibration Facility with ^{238}Pu-Be fast neutron source, may be used (IBN-8-6).

Were built Monte-Carlo models of thermal neutrons collimator, facility and ^{238}Pu-Be fast neutron source using MCNP-4b code. Defined energy distribution of flux density of Neutron Capture Gamma-Ray for Titanium and Nickel targets.

For instrumental support of the experiment at SPE "ATOMTEX" was specifically manufactured Spectrometric Detector BDKG-19M NaI (T1) 63×160mm with nonlinear channel-energy conversion characteristic in range to 10 MeV. Were acquired results for Ti, Ni, and Fe targets, and without a target for open ^{238}Pu-Be neutron source.

During the experiment possibility to use Neutron Capture Gamma-Ray field formed by thermal neutron collimator of AT140 Neutron Calibration Facility with ^{238}Pu-Be fastneutron source with Ti and Ni targets for calibration NaI (Tl) spectrometers for energy to 10 MeV was confirmed. Closely stationing polyethylene plate in the

channel of collimator provides significant increase in output of reference radiation from target simultaneously decreasing unneeded parts of the spectrum.

To decrease flux of thermal neutrons using borated polyethylene is recommended.

Koroteeva D.

Belarusian State University, Minsk, Republic of Belarus

THE INSECTS – VISITORS OF MALVA ALCEA L. IN BELARUS

Analysing of anthophilous insects communities has a great significance in the process of studying of the symbiotic relationship between pollinators and plants. Anthophilous insects as pollinators play an important role in the pollination and seed reproduction of plants. Pollinators can provide the efficiency of seed production process in many different ways. Studying the species composition of pollinators of any particular plant may help in predicting similar results during studying of another plant from this family or genus.

Malva alcea L. is an introducent in Belarusian flora. Thereby studying of pollinators' community may help in the process of analyzing interspecies communication between different similar to *Malva alcea* L. plants during the process of introduction process of *Malva alcea* L. to our flora.

The collecting of insects was held during July, 2016. Insects were caught on the territory of the botanical garden of biology faculty of BSU, Minsk. Insects were caught one by one in the moment of visiting the inflorescence of *Malva alcea* L., then they were placed in the tubes with alcohol for pollen cargo analysis. The taxonomic identification has been established with the key.

Malva alcea L. is a plant in the mallow family native to southwestern, central and eastern Europe, also it can be found in southwestern Asia. It is a herbaceous plant growing to 125 cm tall. The flowers appear singly in summer to early autumn. They are about 6 cm in diameter, usually with five sepals and five bright pink petals. This plant is the most common in drier soils in thickets, along paths, in waste places. *Malva alcea* L. can make natural hybrids with the closely related *Malva moschata* L. In central Europe it can grow at altitudes of up to 2,000 m.

We found 5 species of Hymenoptera – visitors of inflorescences of malva, which are listed in the following diagram:

Family	Genus	Species
Apidae	Bombus	*Bombus terrestris* L.
		Bombus hypnorum L.
		Bombus lapidarius L.
Anthophoridae	Tetralonia	*Tetralonia macroglossa* Rossi
Halictidae	Halictoides	*Halictoides dentiventris* Nylander

Species of genus Bombus are polythrophic pollinators of flowering plants, *Tetralonia macroglossa* Rossi were registered on Malvaceae plants only in other places, *Halictoides dentiventris* Nylander prefer to visit inflorescences of plants from Campanulaceae family.

All of these species were registered on the inflorescences of malva for the first time in Belarus.

In this way, there were 5 species of Hymenoptera marked as visitors of the inflorescences of *Malva alcea* L., which belong to the Apidae, Anthophoridae and Halictidae familes. In the future we are planning to continue our research, including pollen cargo analysis.

Kovalev V., Zhuraukou E., Goncharova N.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

EVALUATION ABSORBED DOSES IN GENERATIVE ORGANS POPULATIONS OF SCOTS PINE IN NAROVLYANSKY AND FORESTRY VIETKA

The purpose of research – evaluation of absorbed doses in the generative organs of pine populations in Narovlya Vetka forestry. Studied experimental plots are contrasting level of radioactive contamination, but the background on the physicochemical properties and heavy metal contamination. The largest contribution to the absorbed dose plant generative organs makes ^{137}Cs. Dose rate in experimental plots ranged from 7 to 140 mGy / year, compared to 0.14 mGy / year in the control plot.

To calculate the radiation dose to the generative organs of pine trees used a specially designed dosimetry model. To calculate the radiation dose generated by 137Cs γ-rays, forest ecosystem has been divided into 5 zones on the vertical profile. Three upper zones are elevated part phytocenosis, others characterize forest litter and soil layer thickness of 5 cm.

In developing the conceptual scheme dosimetric models made the assumption of a uniform distribution of radionuclides within each zone. Thus, each of the zones shown in Figure 1 viewed as a source of an infinitely long (endless “plate”) with a uniform distribution of activity. The objects for which the estimated radiation doses – generative organs of pine trees, are concentrated within the uppermost zone called "the crown of woody plants." This zone is a collection of two thick endless radiation sources, one of which is located above and the other - below the level at which the selection was carried out of the generative organs of pine trees. When calculating the dose rate, radionuclide formed by gamma-radiation, distributed within the areas "woody plants Crowns", "Under crowns layer", and zones that simulate layers of soil-litter system, using an idea – "a source in the form of thick plates for protection." In this case considered as protection layers disposed above the source layer.

Studied experimental sites are contrasting the level of radioactive contamination, but on the background of physical and chemical properties and contamination with heavy metals. The largest contribution to the absorbed dose of generative organs of plants making 137Cs. Dose rates in experimental plots ranged from 7 to 140 cGy / year, compared to 0.14 mGy / year in the control plot.

Kresova E.[1], Kundas S.[2], Suprinovich Yu.[3], Kuzhelko D.[1]

[1]International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;

[2]Belarusian National Technical University, Minsk, Republic of Belarus;

[3]International Charitable Public Association «EcoStroitel», Minsk, Republic of Belarus

MODELING OF TEMPERATURE CHANGE DYNAMICS IN ENERGY EFFICIENCY BUILDING

Environmental ("green") construction makes a significant contribution to the realization of sustainable development. It provides: 1) energy and resource saving, the use of waste, minimization of emissions of greenhouse gases and toxic substances; 2) harmony with the local climate, traditions, culture and environment; 3) the ability to maintain and improve the quality of life preserving the ecosystem on local and global levels.

In Belarus International Charitable Public Association «EcoBuilder» began to develop the direction of environmentally friendly individual building. According to technology of this organization individual houses were built in the village Stahovtsy, Myadel district, Minsk region and in the village Old Lepel, Lepel district, Vitebsk region. Currently, Private Production Unitary Enterprise «EcoBuilder» is active promoting this direction at Belorussian market. Wide use of local thermal insulation materials (reed, a mixture of clay-straw, clay-chips, ecowool and etc) is one of features of technologies used by the company.

Application of new insulating materials requires research of their efficiency, especially if these materials are used in multilayer structures. Perspective direction of solving this problem is a computer simulation. Often it is impossible to apply modern commercial software systems according to specifications for these purposes without their adaptation and refinement. Therefore, the aim of this work is developing of models which describe thermal characteristics of analyzed home with possibility of these models practical usage in software COMSOL Multiphysics and conducting research of efficiency of local thermal insulation envelope materials.

Preliminary numerical studies of developed thermal models showed that for calculation of whole house special high-performance computing equipments are required. Therefore, in present work temperature change calculation was carried out by supercomputer "SKIF" of UIIP NAS Belarus.

The dynamics of the natural cooling of buildings in winter during a day is investigated. Numerical analysis was done for framework type homes where following options of thermal insulation envelopes are: 1) reed (400mm); 2) reed and clay-straw (100 mm+300 mm); 3) reed (50 mm) + ecowool (200 mm) + flax fibers (50 mm). For comparison, a similar analysis was carried out for house with brick masonry 400 mm.

Results of experimental studies show that all used in construction local materials provide effective thermal insulation of houses. During the day temperature is reduced by 5–7 °C (in a brick house temperature is reduced by 14 °C). Thermal insulation system based on ecowool is characterized higher thermal insulation properties.

Kunitsa A., Mukina K.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ANALYSIS OF ENVIRONMENTAL ASPECTS AND DETERMINATION OF THEIR IMPORTANCE IN THE BRANCH OF MTAC-3, RUE"MINSKENERGO"

Minsk TPP-3 is part of a single production-technological complex for the production, transmission and distribution of thermal and electric energy. For the production of energy and heat on mtec –3 the following unit: the power unit CCGT-230 includes a combined-cycle plant with two circuits of the steam pressure intended for the production of electricity and heat.

The composition of the thermal scheme of CCGT-230 includes the following equipment:

one gas turbine of type GT13E2, produced by ALSTOM with a generator of type 50WY21Z-095;

one horizontal two-loop drum boiler type HRSG/DP 01.1/production company SES ENERGY Slovakia;

one steam turbine of the T-53/67-8.0 CJSC "Ural turbine plant" generator type TF-80-2У3;

auxiliary equipment;

- automated control system of technological process.

PSU -230 (steam and hot water boilers and combined cycle plant) are sources of emissions of harmful substances that are emitted through the stationary emission sources (chimneys).

At TPP-3 is made for two recycling systems of WO-1 and WO-2 to cool the main and auxiliary equipment.

The aim of this work is the identification of environmental aspects and determining their significance. The significance of environmental aspects was determined by the method in accordance with the "Regulation on the identification and

formation of environmental aspects, determining significant environmental aspects, objectives, planned environmental performance and Programs the environmental management".

Environmental aspects that arise in the process, MTAC-3 needs to directly control and manage. After identifying environmental aspects, the company evaluates its importance in scores on environmental aspects:

1) 101–57 is the most important;

2) 56–29 important;

3) 28–21 – unimportant;

4) Less than 21 – unimportant.

MTAC -3 conducts continuous measures for elimination of ecological aspects. Important environmental aspects, mtec –3 are:

1) the Use of artesian water (74 points);

2) Long-term storage of waste hazard class 2 (vanadijsoderzhashchih sludge), waste disposal 3cl. danger (46–34 points);

3) Strait chem. reagent 2 cl. danger, coolant, oil, petroleum (44–32 points);

4) Emissions of pollutants from emery machine, not equipped with the GOU, and the exhaust gases (38–37 points).

MTAC –3 on the identified significant environmental aspects is a programme of activities that must be performed to manage significant environmental aspects.

Levchuk A., Golovatyi S.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ANALYSIS OF THE IMPACT OF ENTERPRISE JSC "KOBRIN BUTTER AND CHEESE FACTORY" ON THE ENVIRONMENT

Milk processing industry is one of the sectors of the economy of Belarus, which affects to the environment.

The study aims to analyze the impact of the enterprise JSC "Kobrin BCF" on the environment.

Analysis of air protection at JSC "Kobrin BCF" incinerators identified that environmental activity provides inventory of atmospheric air emissions sources to verify compliance with standards for maximum permissible emissions of pollutants into the air from stationary sources and norms of the content of harmful substances in exhaust gases of mobile sources of pollution.

The company controls using and recovery of ozone-depleting substances and checking the technical condition of air protection of installations, facilities and equipment, compliance with the rules of their operation.

Analysis of environmental aspects at each stage of the life cycle of dairy products has allowed assessing the potential cumulative effects of the enterprise JSC "Kobrin BCF". The most significant environmental aspects in the production of

dairy products are: emissions of pollutants into the atmosphere; discharges of pollutants from wastewater; increased load on waste water; the formation of wastes; using of energy resources; pollution of environment components.

Structural units, where is a high likelihood of significant environmental aspects are: the compressor and the transport sections.

For the significant environmental aspects where proposed measures that have to reduce the risk of their occurrence at the enterprise JSC "Kobrin BFC", which are:

1. Using the refrigerants that don't contain chlorofluorocarbons (CFCs) and the elimination of leaks in the cooling system;
2. Modernization of the fleet of the enterprise, the use of Euro 4 engines;
3. Modernization of treatment facilities;
4. Implementation of safe, hygienic, does not require treatment and minimize the manual labor of waste management systems;
5. Separation technology, cooling and sanitary sewage wastewater directions for processing;
6. Development of the monitoring and control of wastewater discharges;
7. Continuous sampling and continuous monitoring of main operating parameters in order to identify and reduce production losses and, as a consequence, the reduction of the amount of wastes, energy and water consumption.

Liantaushchyk M., Chernetskaya A.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

BIOINDICATION OF POLOTSK AIR BASIN ON VEGETATIVE ORGANS OF SCOTS PINE (PÍNUS SYLVÉSTRIS)

Nowadays environmental quality assessment is carried out on the basis of environmental monitoring, which is an essential part of biological monitoring, in the implementation of which most researchers prefer phytoindication which is based on a study of the level of anthropic influence on the reaction of plant objects.

Amongst of the most sensitive biological objects in according to environmental pollution are the conifers, which primarily react on air pollution, which manifests itself in changing their morphological and physiological characteristics.

The aim of the work is in studying the response of Scots pine (Pínus sylvéstris) on the state of the air basin in the urban environment and in identifying the degree of suppression of certain plants organs.

To carry out the work four sites were selected which differ in the degree of anthropic influence. The first site is a pine forest outside the city limits, was chosen as the site of the least contamination. The second site is the pines growth, which grows on the roadside outside the city limits. It was chosen as the site of a suspected minor anthropogenic influence. The third portion is the pines plantations at the Mound of Glory in the park named after the 50th anniversary of Soviet power. The fourth site

is a pine plantation on Zygina Street of Aerodrome neighborhood, which has a high level of environmental pollution. To conducting the study were selected young pine that grew from each other by 20–25 m. Needles of the last year of life had been examined, it was determined by the grades of damage: no damage - first grade, up to 40% damage – 2nd class, from 40% damage - 3rd grade, and life expectancy. With these data and special tabulations were made conclusions about the air quality in the area of the study. The study results are given in Table 1.

Table 1. – Results of the study of Scots pine (Pínus sylvéstris) needles

Number of site	Grades of needles damage		
	1	2	3
1	89%	9%	2%
2	54%	35,33%	10,67%
3	63,33%	30,33%	6,33%
4	15%	36%	49%

A study of plantations of Scots pine (Pínus sylvéstris) conifer revealed that the state of the air basin of Polotsk may be considered as conditionally normal. At different sites were obtained following results: the degree of air pollution in the first site – I (perfectly clean), the second – III (relatively clean), the third – II (clean), and the fourth – IV (polluted). The study of needles confirmed that the worst air quality observed in the fourth site: Zygina Street is one of the main highways of the town, which lies close to the railway tracks. Thus, the method proved to be accurate, simple to implement, does not require great physical and economic cost, what makes it relevant.

Liantaushchyk M., Susha A., Luchina V.

Belarusian State University, Minsk, Republic of Belarus

TO A QUESTION OF VALUE TERMS OF HUNTING FOR EUROPEAN BISON WITHIN HUNTING TOURISM IN REPUBLIC OF BELARUS

European Bison is the largest animal of European fauna. This species is included in the IUCN Red List of Belarus, Russia, Ukraine and other countries, where it founds today. However, Belarusian bison population is ready for geting out of the IUCN Red List of the Republic of Belarus.by efforts to preserve s appearance by efforts directed on saving the species. On the territory of our state European bison lives in the eight micropopulations in different parts of the country. The data on the distribution of European bison in Belarus and its population presented in Table 1.

Table 1. – Distribution and number of European bison in the territory of the Republic of Belarus.

Micropopulation	Strength		
	2011	2015	2016
Belovezhskaya	415	462	480
Pripyatskaya	87	88	88
Borisov-Berezinskaya	35	28	28
Polesskaya	76	113	116
Nalibokskaya	79	88	85
Osipovichskaya	152	308	350
Ozerskaya	139	187	196
Krasnoborskaya	—	50	85

In this regard, in accordance with the Presidential Decree of December 8, 2005 № 580, on the territory of Belarus authorized hunting in the reserve gene pool of European bison population. An old and sick animals, injured, aggressive towards man and lured away by more than 50 kilometers beyond the forest for a long time belong to reserve gene bison pool.

Most of the hunting farms offer the hunting from October to March, when the bison wool is considered the best in quality, although many farms offer hunting throughout the year. The cost of hunting varies from 150 € to 600 € per day, but different organizations exhibit cost up to 10 thousand. € excluding the trophies.

As a trophy hunters are offered the horns and skull, lower jaw, skin, hooves. In evaluating the trophies CIC point scale system are used which takes into consideration the length, thickness, weight, color of the horns and other features. The cost of trophies in accordance with points given in Table 2.

Table 2. – Ballroom CIC system.

CIC points	Cost (thousand €)	
	min	max
From 170 (gold medal)	15	20
From 150 (silver medal)	13	17
From 130 (bronze medal)	11	15
To 130	5	10

This type of hunting tourism brings considerable profit for our country, which is consumed, in particular, and for maintaining environmental protection activities.

Liantaushchyk M., Susha A., Luchina V.
Belarusian State University, Minsk, Republic of Belarus

LEGISLATIVE REGULATION OF HUNTING FOR EUROPEAN BISON IN REPUBLIC OF BELARUS

Today, one of the increasingly popular types of hunting tourism is hunting for bison. On the European continent is the one of the largest and most heavy representatives of terrestrial mammals. European bison is the last representative of the European wild bulls. The body length of bison can reach 330 cm, the weight can be up to 920 kg. Height at the withers in the adult animal reaches up to 192 cm. The population of bison in Republic of Belarus is about 1.5 thousand individuals to February 2016.

Belarusian population of bison is consists of individuals of the main and reserve gene pool of animals. The primary bison gene pool includes individuals representing the breeding value meaningful for maintaining the Belarusian population of European bison, and having high physical condition. The reserve bison gene pool includes old and sick animals, injured, aggressive towards man and lured away by more than 50 kilometers beyond the forest for a long time.

In accordance with the Presidential Decree of December 8, 2005 № 580 "On Certain Measures for improvement of the effectiveness of hunting management and fisheries management, improvement of public management" (in the Decree of the President of the editorial board of the Republic of Belarus of July 23, 2010 № 386, which entered into effect from 13 November 2010) and Decision of the Council of Ministers dated October 27, 2007 № 1408 "On some issues of protection and rational use of European bison" permitted the hunt for bison of reserve gene pool.

Today on the territory of the Republic of Belarus hunting for bison is conducting in 8 hunting grounds and allowed to hunt on animals of any sex and age of the gene pool of reserve during the year. The best hunting time is at the end of January and all of February. Shooting can not increase more than 75% of the population. Which of the bison should be taken away is decides by Commission, composed of experts from the National Academy of Sciences of the Republic of Belarus, regional environmental organizations and the state veterinary service.

Despite the fact that the bison is in Red Data Book of the Republic of Belarus, the hunt for It brings to our state considerable profit from 600 to 1050 euros for the hunt, with the trophy itself - from 1000 Euro to 10 000 or more, depending on the quality of extracted animal on CIC defined rating system. As trophies the horns and the skull, lower jaw, skin, hooves are available. The rest of the dead animal remains in the possession of the organization.

At numerical score of horns take into account their length, thickness, weight, color and other attributes, and the horns weights are determined their power. This measurement is made in a special trophy list, which also indicate who, where and when had kill the animal, its weight (total and without viscera).

Legislative regulation of hunting for European bison in Republic of Belarus addresses two critical issues: first, improve the population by rejection of sick, old and debilitated animals, related to the so-called reserve gene pool; second, it is the source of profit for maintenance of national parks and reserves of our country.

Malyha O., Mukina K.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

COMPARATIVE ANALYSIS OF THE METHOD OF WESTWATER TREATMENT GALVANIC PRODUCTION AT JSC "METZ V. I. KOZLOV" EXISTING CLENING METHODS

JSC "METZ V. I. Kozlov"refers to the electrical industry companies and specializes in the production of power transformers of different types of package transformer substations and switchgear, transformers, multi-purpose, current transformers, complete switchgear, as well as a wide range of consumer goods.

The purpose of this paper is to analyze the wastewater treatment method of electroplating in the company of "METZ V. I. Kozlov "and the analysis of existing cleaning techniques.

One of the important environmental aspects of the company is the discharge of waste water electroplating. Contact with untreated or inadequately treated sewage and other pollutants containing non-ferrous metals in water bodies is detrimental to the national economy and the environment.

Electroplating is one of the most dangerous sources of environmental pollution, mainly from underground water, due to the formation of a large volume of waste water containing contaminants of heavy metals, inorganic acids and alkalis, surfactants and other highly toxic compounds as well as a large number of pollutants, especially by the method of reagent disposal of waste water containing heavy metals form sparingly soluble.

A diverse range of coatings applied by electroplating electroplating causes the variety of contaminants that are in the waste water.

If the basis for classification of wastewater treatment process to adopt the prevailing (or main unit) of a particular method, they can be divided into seven groups: mechanical, chemical (reagent), coagulation-flotation, electrochemical, sorption, membrane, biological.

Analysis of wastewater treatment galvanic production showed that the most effective methods is the method of electrocoagulation, which relates to an electrochemical method.

The company of "METZ V. I. Kozlov "reagent used method of waste water treatment galvanic production. At the heart of the process of neutralization of effluents containing hexavalent chromium is a chemical reaction between ions and ferrous chromate. Wastewater treatment practices found that by co-precipitation of

hydroxides of two or more metals at the same pH value achieved better results than the case of separate deposition of each metal. In order to achieve the best wastewater is recommended to use sodium hydroxide (NaOH), because it is highly reactive; precipitates obtained with its use, are relatively clean, easily washed, processed and effectively separated during clarification. This method is the most versatile and easy to use.

Mamayko A., Boyko M., Merkulova I.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE PROSPECTS OF INTRODUCTION OF ALTERNATIVE METHODS OF ASSESSMENT OF SAFETY OF PERFUMERY AND COSMETIC PRODUCTS IN REPUBLIC OF BELARUS

The attitude of the person towards animals, including experimental, is one of key questions of bioethics. In the last decade there is an active process of an institutionalization of the principles of the ethic attitude towards animals that is reflected in the marine life protection acts of animals from cruelty adopted in many countries.

Striking example of the solution of an ethical dilemma of use by the person of animals for ensuring own safety, is the prohibition of production and sale of the cosmetics tested for animals, accepted in the EU in 2013. This law was preceded by long-term organizational, research and legislative work on creation of the national and international centers developing and implementing alternative evaluation methods of safety of cosmetics.

So, in 2011 the EURL-ECVAM laboratory (European Union Reference Laboratory for alternatives to animal testing) which is engaged in development and check of new alternate methods and recommendations to their use, independent examination was open. Inclusion of the alternate methods in guides of OECD (Organization for Economic Co-operation and Development) makes them officially available worldwide.

Similar approaches are applied in the USA, Norway, Israel, India and New Zealand where developed infrastructure (the research centers of alternatives) and legal base for introduction of alternatives is created.

Today tens of alternatives of in vitro (use of cell-like cultures and tissues of the person, for example, such as EPISKIN), ex vivo (BCOP test), in silico (computer model operation) are already developed.

Many known cosmetic companies finance development of alternatives to toxicological testing for animals; on social networks "white" and "black" lists of cosmetics are popular.

In Belarus the bill "About the Treatment of Animals" is drafted long ago, however it cannot still be approved for 10 years.

In vitro methods that are already introduced in the Republican unitary enterprise «Scientific and Practical Center of Hygiene» replace assessment of irritant action of tools for care of skin. They are prime in use, not expensive, demanding small concentration of the tested substance, reducing research volumes, and the most important is efficient.

Requirements to check of toxicological safety of perfumery and cosmetic production are assumed by the complex analysis of substance (structure, degree of danger of each ingredient) then assessment method is chosen: either laboratory animals, or the alternate biological models. However, in our country there is no organization which would be engaged in their introduction and financing.

Maslovskaya E., Kundas S.

Belarusian National Technical University, Minsk, Republic of Belarus

WIND POWER IN BELARUS – CURRENT STATE AND PROBLEMS

Renewable energy sources (RES) are becoming very popular nowadays displacing fossil fuels. It goes without saying that consumption of conventional sources of energy can lead to serious environmental consequences such as air and water pollution, global warming (when we burn fossil fuels carbon dioxide releases), acid rains (because of sulfur dioxide),greenhouse effect, harmful impact on aquatic life by oil spill, etc. But it's also very necessary to single out that there are some economic issues that must be solved: for example, firstly, some countries has to import oil and natural gas from other countries where these resources are available in abundance, secondly, prices are really high, etc.

Nevertheless, the problems of the list are being addressed. Using the latest technologies and innovative approaches is vital; consequently energy is one of the priorities of science and technology development in most countries inside and outside the EU, including Belarus.

Belarus can't meet its needs for energy with domestic sources because its mineral resources are quite limited. The country has to import fuels and energy (about 80%), mainly from the Russian Federation. And one of the main aims of Belarus in energy sector is to increase the use of local energy resources especially renewable energy including energy of wind.

Wind power is the leading source of new power generating capacity in the world (3,7% of global electricity production) and playing a major role in meeting electricity demand in an increasing number of countries, including Denmark (42% of demand in 2015), Germany (more than 60% in four states) and Uruguay (15.5%). China added a staggering 30.8 GW of new capacity in 2015, for a total exceeding 145 GW – more wind capacity than the entire EU. While most countries have some small-scale turbines in use, the majority of units and capacity operating at the end of 2014 was in China (343.6 MW), the United States (226 MW) and the

United Kingdom (132.8 MW). Other leaders included Italy (32.7 MW), Germany (24 MW), Ukraine (14.6 MW) and Canada (13.1 MW). It's a clean source of renewable energy that produces no air or water pollution. And since the wind is free, operational costs are nearly zero once a turbine is erected.

There are three regions with the largest potential to produce electricity from wind turbines in Belarus: Grodno, Minsk and Mogilev regions with average wind speed of 5.5–6.5 m/s near the ground and 6.5–7.5 m/s at the height of 40 m.. At the moment 56 windmills are installed in Grodno, Minsk, Vitebsk and Mogilev Regions (total capacity – 43.2 MW). The first wind park in Belarus with capacity of 9,0 MW was installed in Grabniki (Grodno region) this year. It includes 6 power units (China production) with capacity of each – 1.5 MW. The height of tower each unit is 90 m, blade length – 40 m, annual average electricity production is about of 84 GW.

Doubtless, we see that this trend is promising enough, but some problems exist too, which hampering of wind energy development in Belarus. Main of this problems are high investment cost and absence of national producers of wind power units, low level of feed-in tariffs for wind energy (1,2 at present); absence of wind speed measurement on the wind turbines placement (70–100 m) and others. So this work is dedicated to the analysis of current state of wind energy in the world and Belarus and the discussing of above mentioned problems.

Mikhailyuk M., Ivaniukovich U.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ASSESSMENT HEAT IMPACT OF THE BELARUSIAN NUCLEAR POWER PLANT ON ENVIRONMENT

One of the possible options of the ecological impact of the Belarusian nuclear power plant on the environment is thermal pollution. The thermal emissions of the NPP can lead to changes of the air temperature, formation of fogs, drizzling, increase of icing probability. All these make a direct impact on the condition of the soil, vegetation, roads and constructions in the area of influence of the plant.

As a rule, the main sources of thermal emissions are the cooling systems of power stations, an evaporative cooling tower is included. Cooling towers are heat exchanging devices, which cool the water through evaporation and heat convection transfer of the tower. A large amount of warm and damp air is emitted into the atmosphere by the cooling tower through its mouth during the operation. It results in a steam-torch that has a direct impact on the environment.

Further distribution of the thermal emissions from the NPP is influenced by the climatic features of the territory and the structure of the constructions of the industrial site and adjoining territories. A preliminary assessment of the direction and speed of the wind in the area of the NPP, taking into account the influence of the

difficult land relief, artificial obstacles and the roughness of the surface will allow to predict more precisely and fully the distribution of the emissions from the nuclear power plant.

Mathematically, the process of the convective heat transfer and the movement of gas in the atmosphere is described by the Boussinesq approximation. This model includes the Navier-Stokes equation, the heat equation and the continuity equation. The main idea of approximation consists in particular accounting density depending on the temperature.

As a modeling tool the modern software package COMSOL Multiphysic is selected. This software allows to consider geographical and climatic features of the chosen site, and also to set all necessary elements of infrastructure of the NPP. To solve the partial differential equations, COMSOL Multiphysics uses the finite element method. An important advantage of COMSOL Multiphysics is that this package contains a set of ready-made modules for different fields of physics. The Heat Transfer module contains simulation tools to study the mechanisms of heat transfer – conduction, convection, and radiation. This module was used for the solution of the objective

As a result of the simulation were obtained temperature fields in all directions of the wind and for various external weather conditions. Because Temperature has a direct effect on the humidity level around the nuclear power plant cooling towers, it was built a map of average land value increment specific humidity.

Analyzing the results of calculations we can conclude that heat and humidity outputs of cooling stacks in NPP with described characteristics will not impact greatly on the microclimate of the nearby territory because average annual ground temperature and humidity increase is insufficient.

Milevich K.[1], Lozinskaya O.[2]

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

USING TRIFOLIUM REPENS AS BIOINDICATOR OF ENVIRONMENTAL QUALITY

A bioindicator is any biological species (an "indicator species") or group of species whose function, population, or status can reveal the qualitative status of the environment. Bioindicators can be plants, animals or microorganisms.

The use of bioindicators is fundamentally different from classic measures of environmental quality and offers numerous advantages. Bioindicators add a temporal component corresponding to the life span or residence time of an organism in a particular system, allowing the integration of current, past, or future environmental conditions; they can also indicate indirect biotic effects of pollutants when many physical or chemical measurements cannot. In most cases they are inexpensive compared to chemical methods.

Many plant species are good indicators of pollution, because they are acutely tuned into and affected by their environment. Under exposure to high concentration of pollutants, plants suffer acute injury with externally visible symptoms, such as chlorosis, discolouration, necrosis and death of entire plant. Besides morphological changes, biochemical, physiological and fine structural changes also occur in plants.

The object of the study was the widespread bioindicator Trifolium repens (creeping white clover). In this work was considered the phenomenon of genetic polymorphism of Trifolium repens. Populations of white clover are characteristically polymorphic for white leaf marks. The white marks appear as bands on the laminae as a result of air spaces within the palisade tissue. This trait is genetically determined and inherited as a monogenic. Two linked groups of genes control leaf marking in Trifolium repens; the white leaf marks are controlled by multiple alleles at a locus in one of these groups. The ratio of different phenotypes of bioindicator plants allows to make conclusions about the magnitude of the accumulated mutations cargo of organisms in various conditions of anthropogenic load.

The collection and identification of plant materials was performed during the flowering period (June-July). A total of 2 100 plant specimens were collected from 21 plots on the territory of Minsk and International Environmental Park "Volma".

In a study of genetic polymorphism 23 phenotypes of white clover were found (on average, from 7 to 10 phenotypes within a natural population of white clover). In all populations the predominant genotypes were vv, Vv, VV and VHVH. It was found that the lowest degree of vv phenotype was observed on the territories with high anthropogenic loading (11% – Alibegova st., 17% – Vaneeva st., 19% – both Taschkentskaya st. and Masherova av., 21% – Fizkulturnaya st.). And, on the contrary, the highest degree of vv phenotype was observed in uncontaminated areas, such as Zaparojskaya st. – 48%; Independence av. – 50% and the territory of International Environmental Park "Volma" – 53%. In the conditions of high anthropogenic load was noted the presence of atypical leaf blades as the result of mutations (from 1% to 3% at different plots). The reason for such differences may be contradictory proximity of some recreational areas to the city's transport lines and acting companies in the petrochemical, power, machine building, building materials, etc.

Morozko A., Len E.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ASSESSMENT OF SYSTEM OF WATER SUPPLY AND SANITATION RUE "NATIONAL AIRPORT "MINSK"

The main activities of the company related to servicing aircraft, passengers, baggage, cargo and mail, rendering of services for commercial aircraft maintenance and security of passengers on-Board meals.

The hydrographic network of the study area represented by R. Usha (the Dnipro basin) and a network of drainage canals that flow into it.

Water management of RUE "national airport "Minsk" represented by a system of potable, industrial and fire water and two sewer systems.

Water is from 4 wells, located to the Northwest of the settlement Shemetovo.

Household and industrial wastewater from the enterprise's internal networks gravity comes to receiving chamber of sewage pumping station and then pumped to the collector at the wastewater treatment plant the town of Smolevichy.

Rain and melt water from the territory of the enterprise arrive on treatment facilities of rain sewage consisting of:

two ponds with a capacity of 30 thousand cubic meter each;

- pumping station;

- block filters.

The total annual number of surface runoff forming on the pool of rain water drainage of RUE "national airport Minsk is 2 621, 7 thousand cubic meters, including:

• rain runoff – 1 913,6 thousand cubic meters;

• snowmelt runoff – 708, 1 thousand cubic meters.

The main sources of pollution of surface wastewater suspended solids are dust and aerosol particles of unburned fuel, products of destruction of road surfaces and soil erosion, waste street estimates.

The discharge of treated storm water is carried out by sprocname the channel length of 800 m in Usha river 3.5 km upstream of the settlement Shemetovo.

Quality control of potable waters is SE "Minsk city center of hygiene and epidemiology", industrial and domestic wastewater – accredited laboratory sewage treatment plants the town of Smolevichy.

Quality control of wastewater for release from treatment facilities of rain sewage shall Borisov on accredited analytical control laboratory state institution "Republican center of analytical control in the field of environmental protection".

Muraveika V.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE PROBLEM OF WASTE GENERATION AT JSC “BELARUSKALI”.

JSC “Belaruskali” is one of the world’s biggest producers and exporters of potash fertilizers.

The intensive development of large-scale potassium fertilizers production at JSC “Belaruskali”, as well as the specificity of the geological conditions of sylvinite ore occurrence and their mineral composition, lead to a number of specific problems related to environmental protection in the Soligorsk industrial region. One of them is a problem of industrial wastes accumulation.

The industrial wastes of JSC "Belaruskali" are mainly represented by solid halite wastes containing 92–95% of sodium chloride, and liquid wastes – clay-salt slimes, represented by suspended potassium chloride and sodium chloride particles and the insoluble residue in a saturated aqueous solution of these salts.

Annually at JSC “Belaruskali”, with the existing volume of potassium fertilizers production, about 16–20 million tons of halite wastes and 1.5–2.0 million tons of clay-salt slimes are formed. More than 1.9 million hectares are allocated for their disposal as the special salt dumps and slime storages. Currently, the total amount of the wastes accumulated exceeds 700 million tons.

The solid halite wastes are stored at the special salt dumps. On 01.01.2015 the area occupied by the halite wastes was about 616.73 ha from the reserved area of 938.19 ha. On the end of 2015 the total amount of halite wastes amounted to 771 989 thousand tons and the maximum height of the halite wastes dumping hill amounted to 142 m (the special salt dump of the 2nd mine factory).

Clay-salt slimes are accumulated at the special slime storages of JSC “Belaruskali”. The total area of these slime storages is 968.86 ha and the total amount of clay-salt slimes accumulated at them exceeds 92460 thousand tons.

Such a significant amount of the industrial wastes accumulated at JSC “Belaruskali” has a negative impact on the environment, as expressed in the land alienation, groundwater pollution by salts penetrating into aquifers at the sites of industrial waste disposal, as well as soil salinization under the impact of atmospheric precipitation.

Pashyeva U., Mukina K.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ANALYSIS OF ENVIRONMENTAL MANAGEMENT SYSTEM AT JSC «MINSK ELECTROTECHNICAL PLANT NAMED AFTER V.I.KOZLOV» ENTERPRISE AND COMPARATIVE ANALYSIS OF ISO 14001:2004 AND ISO 14001:2015

Minsk Electrotechnical Plant named after V.I. Kozlov is one of world leaders in the field of production of wide spectrum of electro-technical equipment, power transformers, and complete transformer substations, current measuring transformers and the various switchgear devices. The enterprise is certified according to international standards of ISO 14001-2004, which ensure reliability and ecological safety of the manufactured products.

The purpose of work is to analyze differences between the new release of international standard of ISO 14001 and the development of measures for the effective transition to the update version of standard at an enterprise.

While attaining the objectives, production activities and technological processes at M.E.P. named after V.I. Kozlov which affect environment were investigated; the

environmental management system, air protection, water consumption and water removal, waste management were analyzed, besides the consideration was given to the comparative analysis of ISO 14001:2004 and ISO 14001:2015 and the differences of the third release of standard of ISO 14001 as well as to the conformity of ISO 14001:2015. A number of activities for effective transition to the new version of the standard for the enterprise were developed.

Minsk Electrotechnical Plant named after V.I. Kozlov was proposed to develop a plan for the transition to the ISO 14001-2015 the main points of which are:

- development and implementation of transition plan, training all personnel in standard changes, including internal auditors and leadership, identification of those fields that do not meet the new requirements, and where to focus to achieve compliance;
- the alignment of the environmental management system in compliance with the requirements of the new version of the standard, to prepare new documents and adapt management processes, in order to bring them into conformity with the requirements.

Popkova E.

Odessa State Environmental University, Odessa, Ukraine

ABOUT THE POSSIBILITY OF A FRAGMENTED LARGE-SCALE DECONTAMINATION OF RADIOACTIVE OBJECTS

The paper examines the possibility of fragmented decontamination of large-scale projects, in particular, the surface of the soil with significantly morphologically heterogeneous structure.

The heterogeneity of geochemical landscapes (autonomous landscapes, geochemical barriers, etc.) associated with the irregularity of radioactive contamination of the soil surface.

To optimize the decontamination processes and the achievement of economic effect due to the fragmented actions, the using of the Voronoi diagrams method is suggests [1].

For the formalization of the problem, statement discusses the profile of the contamination of the surface of the soil. The results of the distribution of pollution of the studied territory the method of Voronoi diagrams on the ground highlighted the points corresponding to maximum radioactive contamination. If you connect these points by edges, we get polygons with different area and a different number of sides. These regions have name Voronoi shapes.

Earlier in the framework stereological approach we consider the case of two-dimensional systems of disks, in which connections between the distributions of the parameters modeling the functions and characteristics of structures, observed in the configuration space, were found. [2].

For the approximation of the distribution, function of the Voronoi areas of figures is also used the classical theory of moments [3].

As parameters modeling the distribution function of the take area and the size of the Voronoi shapes. Selected figures, corresponding to the maximum value of the distribution function in their area, as well as the Voronoi shape with maximum area and minimum size.

Decontamination of the soil assume conduct of two ways. In the first case, decontamination conduct on plots with an area corresponding to the maximum of the distribution function, in the second case – to carry out decontamination at sites corresponding to Voronoi shapes with maximum area and minimum size. Thus, input coefficients taking into account the terrain profile and the rate of decrease of radioactive contaminants. Coefficients, taking into account the speed, decrease the concentration of radioactive substances depends the diffusion of radionuclides on the soil surface. The method of decontamination (foam, gel, processing, decontamination solution, etc.) in both cases is the same and is selected according to the type of pollution.

Comparative evaluation show preference for other methods of decontamination for their efficacy and efficiency, that suggests the possibility of fragmented decontamination of radioactive objects.

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Poplavsky I., Prybysh P., Karpei A.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

AUTOMATION OF ACCOUNTING TRAININGS OF EMERGENCIES

Nuclear energy is widely used in most industries. Therefore, it requires complex science-based measures for the avoidance, prevention of emergencies and for the protection of humans, the general population and of the environment from the harmful effects of ionizing radiation.

The number of accidents related to nuclear energy, nuclear power plants, significantly less than in other areas of human activity. However, a few years ago was an accident in Chernobyl and it forces to reconsider our attitude towards nuclear power plant safety organization of work and protection from uncontrolled development of

nuclear reaction. It is necessary to further reduce the probability of accidents, although it is likely completely avoid them never succeed.

An effective emergency response system to various accidents and emergencies is one of the basic requirements of safe development of nuclear industry. Conducting of trainings improvement of qualification and maintenance of a high class of emergency personnel are required to achieve high efficiency of the emergency response.

The paper describes the development of an automated system of accounting training (ASAT) in dealing with emergencies in the nuclear industry. The system is based on the use of web-technologies and consists of server and client parts.

The server side consists of database and application, where all business-logic and objective model of data are realized. As an application works with the personal data of enterprises, their employees and training, the two-tier system of safety and complete audit of actions of users are realized.

Client part contains the web-interface and presents from itself one-page application for co-operating with the registration system: input and reflection of data (work both with ordinary data and with files), conduct of calendar of training, reflection of training on a map with the use of GIS-technologies. Because this web-application, access to him it maybe to get from any device, having a modern browser and access in the internet.

ASAT intended for the organization trainings and evaluation of the achieved level of effectiveness of emergency response capability after the passage of these trainings.

Automation of trainings simplify the work of planning and analysis of trainings effectiveness, as well reduce the risk of errors and duplication of information in trainings account.

The ASAT system is implemented by means of modern technologies. The developed system affects positively on the work of the users by increasing the speed of working with information about trainings, conditions of personnel and equipment of rescue units, reducing the time of formation and analysis reports.

Rogovsky V.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

INVENTORY OF FLORA OBJECTS OF JSC "KERAMIN"

Inventory of flora objects is carrying out in the preparation of the making of ecological passport of the company, during the selling or corporatization of company.

The main legal act that determines carrying out of the inventory of flora objects in the Republic of Belarus is the Law of the Republic of Belarus of June 14, 2003 № 205-Z "About Flora". During the inventory of flora objects on the territory of the

company we should guide the provisions of the decree of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus of December 28, 2006 № 79 "About approval of the Instruction of the regularity of registration of flora objects located on the lands of the individual categories and their treatment", because this decree regulates the inventory of flora objects on the territories of companies.

There is no officially approved methodology for inventory of flora objects. Inventory on the enterprise JSC "Keramin"'s territory was held by the method of projections, which involves a comparison of the heights of concrete objects and tree height. Accounting journal of flora objects and maps of the location of flora objects were compiled during the inventory.

Six test plots of different sizes were taken. The total area of inventory was 6482, 6 m^2. The numeration of plots were from 46 to 51. Lots 46 and 47 have massive type of planting of flora objects, which means a plenty of trees growing on a large area. Lots 49, 50, 51 have line type of planting, i.e., an elongate planting of trees, usually of one species of wood. Plot 48 have a group type of planting, i.e. mix between trees and shrubs with flowerbeds.

During the inventory we have identified 209 trees, the total area occupied by trees was 13.74 m^2 (0.2% of the total area). In addition, we have identified 7 shrubs and 17 beds, which percentages were less than 1 too.

What about species, we have identified 14 species of trees and 5 species of shrubs. Four species of trees are widespread. They are poplar black, silver birch, horse chestnut, small-leaved lime. The total number of representatives of these species - 153, what is 73.2% of the total number of trees. Tree peony and lilac ordinary are widespread among the shrubs. We have identified 2 representatives of each species, what is 57.1% of the total number of shrubs.

What about qualitative condition of flora, researches on the territory showed that 60.52% of flora objects, 141 pcs, were in satisfactory condition (mark 4), 43 objects were in poor condition (mark 3), that is 18.45 % of the total number of flora objects. Moreover, 49 objects were in an improper condition, it is 21.03% of the total number of flora objects.

In the process of inventory, we were recording information about objects into accounting journal of flora. The plots were located close to each other, therefore, we were making a single journal for them with numeration and list of characteristics of flora objects according to the law.

Particular attention was paid to the maps of location of plots. We have developed 6 separate maps for each plot. Maps of plots were drawn in a scale of 1: 10,000 in accordance with regulatory requirements. We have used other land documents for making these maps, namely, land plans. Drawings were made using graphical editor AutoCAD.

Abstract. The inventory of flora objects on the territory of JSC "Keramin" has been carried out. Species of flora objects have been identified. The main types of plantings have been identified and schematic maps with the application of all identified flora objects have been drawn.

Ryshkel I., Murashko U.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

COMPARATIVE ANALYSIS OF ENVIRONMENTAL POLLUTION BIOINDICATION METHODS

Nowadays environment is in a state of ecological crisis. It is closely connected with current human activity. Since the highly developed industrial society appeared man's hazardous interference into nature has increased significantly, it has become diverse and today it threatens to become a global danger for humanity. Various methods of air pollution monitoring are used, including methods based on bioindication.

Bioindication is a method of assessment of geophysical environment pollution using plants and living organisms, bioindicators. Plants are an important element of biological monitoring as they react acutely to the state of environment.

One of bioindication method is lichen indication method, which is a method of the assessment of atmosphere pollution using lichen research, and the scots pine needles bioindication method, which is a research for pine needles damage.

To conduct the following research two sample areas of the Pinsk forestry were chosen. After the identification of the lichen species of the sample area and the assessment of each species proportion of the sample total area, we made a calculation of average frequency and cover for each lichen species. We compared the lichen bioindication method research results and on the basis of relative atmosphere purity data it was found out that the atmosphere in Pinsk region (sample area № 1) ranks a bit below in its quality than sample area № 2 in the countryside (mixed forest site near Sokolovka village, Minsk region)

In the reference areas where relative atmosphere purity was assessed with the help of lichens, we evaluated the degree of damage to the scots pine needles.

After analysis of the obtained results, it can be stated with certainty that scots pines growing in the area №1 are under heavy anthropogenic pressure, which reflects on the condition of pines. In the area № 2 only 12% needles have noncritical spots, whereas in the area №1 this figure is 57, 5%, which is five times more.

Both methods deserve attention, but in our research, atmosphere state estimation based on the pine needles condition proved its worth as a more sensitive method, since the difference in the two discount areas was more distinct.

Information obtained in the result of research using these methods allows to indicate the level of atmospheric contamination. In its turn it can help us control the

purity of the air we breathe and consequently decrease the anthropogenic pressure on our health.

Sachnyouk A., Kishkurno D., Khandohiy A.
Belarusian State University, Minsk, Republic of Belarus

DIFFERNTIATION OF GULLS HABITAT CONDITIONS IN THE URBAN ENVIRONMENT OF MINSK

Study of fauna and population of urban landscapes is the actual trend of current environmental research. Especially actively studied avifauna major Western European and Russian cities (Yudin, Firsov, 2002). To date considerable data on the fauna and population of birds in urban areas is gained. However, until recently, it was not so much work, exploring gulls in Belarus (Nikiforov, Shklyarov, 1979).

The proposed work is the first attempt in the relative assesing of qualitative and quantitative composition of the gulls in the urban landscapes of the city Minsk.

The main objective of the work is ecological and faunal study gulls of large city on an example of Minsk.

The studies were conducted from September 2014 till October 2016.

The object of the study were gulls – birds living in the district of river the Svisloch river (within city limits).

Species composition of birds was determined visually according to standard diagnostic features (Peterson, 1985).

For investigating the influence of environmental factors on the structure of communities of waterbirds of Minsk it were being identified the following characteristics of reservoirs: reservoir area, water surface area, the area of the islands surface vegetation. These parameters were determined both visually and with using satellite images in the program OziExplorer v. 3.95.5 n.

We have found that species diversity of the communities of waterbirds in the waters of Minsk in the summer had low levels and ranged from H '= 0,91±0,04 at the Svisloch river and up to H' = 1,3±0,05 on Tsnyanskoe Reservoir.

In all water bodies of Minsk in summer sharing of black-headed gull and common gull higher (by 20% on the river Svisloch and 60% for Chizhovskoe Reservoir.) than the herring gull, caspian gull and lesser black-backed gull) (from 0.3% for the Svisloch river to 7.6% on Chizhovskoe Reservoir.). Consistently high total density of birds wetland complex observed on the river Svisloch in all seasons. In the structure of bird communities the major share of the total bird abundance accounted for Mallard, which ranges from 63.4% in autumn to 91.9% in winter. As for the gulls, the share of blue-gray and black-headed gulls increased from summer to winter – from 8.8% in the summer to 10.4% in the autumn and of 8.3% in summer to 18.7% in the spring respectively. Their differences are determined by the presence of local features related to environmental habitat conditions: degree of overgrowing of coastal aquatic vegetation, anthropogenic load on the coastal zone

of the river bed and a cascade of reservoirs, rich habitats and other favorable living conditions in urban areas is enhance the ecological capacity of the species and groups of species of gulls as a whole. The main factors influencing the difference in the structure of communities of waterbirds reservoirs during the summer period, which includes gulls bird is overgrowing of coast with vegetation on the perimeter, which should be 0.20.

Thus, the analysis of the impact of environmental factors on the difference communities of waterbirds of Minsk showed that the ponds favorable for habitat of gulls are reservoirs: Chizhovskoe, Tsnyanskoe and Drozdy.

Sakharuk P., Ivanov D.

Belarusian State University, Minsk, Republic of Belarus

USE OF HERPETOLOGICAL DATA FOR RECONSTRUCTION OF ENVIRONMENTAL CONDITIONS

During the Quaternary period recurrent coming of glaciers from Scandinavia to the East European Plain forced animals that were living there to migrate as temperatures were decreasing and natural zones were changing. It influenced on all species, but especially – on ectothermic (cold-blooded), which include reptiles and amphibians. In addition to the disappearance of herpetofauna directly from areas covered by glaciers, the number and diversity of species varied considerably in periglacial zone too. But, if small mammals used to form specific complexes that are not typical for nowadays and help to identify the climatic conditions of their existence, for amphibians and reptiles only the degree of diversity distinguishes assemblages from different climatic periods.

However, herpetological information can be very useful for biostratigraphy. At first, the presence of representatives of the cold-blooded animals in sediments suggests the absence of ice cover in the area. Secondly, the change of forest associations in the forest-steppe and steppe, under the current forest area, may indicate a climate aridization as a result of proximation of climatic conditions to glacial. Also, some types of amphibians that have shown changes in their areas of distribution in the past may be used to determine regional stratigraphic age, but only relatively large intervals. Nevertheless, each case within the history of the area should be examined carefully.

There are different approaches to reconstruction of paleogeographic and paleoclimatic conditions according to the data of research of herpetofauna. European method relies only on the composition of species in the burials, not taking into account the number of specimen or the taphonomy of a location. This approach may lead to wrong conclusions, which can be avoided if you take into account the proportion of species belonging to different ecological types. Considering this aspect, we can talk about the predominance of certain habitats, and therefore - about exist-

ing natural area. Reconstruction of the natural area, in its turn, carries the information about the landscape and the climatic conditions.

Speaking of landscape trends, reconstructed according to the remains of amphibians and reptiles, we can say that in the Pleistocene constant change of natural zones for the entire interglacial stages occurred. This conclusion does not contradict the data of palynological research. However, it should be noted that, as the pace of evolution of amphibians and reptiles is quite slow, detection of assemblages consisting only of modern species is not an indicator of their young age and a detailed division of the Late Cenozoic sediments on such paleontological basis is impossible, but it allows us to speak about certain climatic rhythm fauna exists within.

Samusik E., Golovatyi S.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

INFLUENCE OF CEMENT INDUSTRY ON THE ENVIRONMENT

Modern industrial production has a significant impact on the environment on a global scale. Contamination of the environment by industrial emissions has a negative impact on human health and on the environment as a whole. Today in the CIS countries, there is a rapid development of the industrial production of cement, dry mixes, concrete and concrete products, which in turn has not the most favorable impact on the environment, and even in Western countries, where there is a strict law on nature protection, the problem is very serious.

The production of cement is based on the use of non-renewable raw materials. The enterprises of the cement industry to the environment are allocated annually more than 27 million tons of dust. They account for 2/3 of the industrial emissions of solids and 44% gases.

According to CPCB *(Central Pollution Control Board)* cement industry is one of the 17 most environmentally damaging industries.

This production activity is a significant factor constraining development of the industry both in terms of environmental and economic costs and regional environmental constraints. This requires the integration of environmental factors that influence the formation of the cost of production, starting with the mineral extraction phase and ending with the production, transportation and use in the construction of the finished product. Among requiring consideration of environmental problems should be allocated associated with exposure to specific ecosystems:

1. Air pollution is generated by emissions from industrial processes:

- in the cement industry: cement dust emissions; gaseous emissions, including CO_2, which according to researchers in the construction industry makes up 25% of all global emissions of industrial production; fast evaporating emissions from smokestacks components;

- during the extraction of mineral raw materials: dust emissions from mining and primary processing of the rock mass; specific gaseous emissions from blasting, dust emissions from the waste dumps;
- during the transport of raw materials and finished products: emissions of pollutants from the operation of vehicles.

2. Rejection and violation of land:

- during construction and operation of a plant for the extraction of minerals: mining allotment, land transport and communication infrastructure, the formation of heaps;
- when placing the cement production facilities and creation of sanitary protection zone.

3. Pollution of the hydrosphere:

- during construction and operation of a plant for the extraction of mineral raw materials: the formation of depression cones due to water pumping (the area of craters can be up to 200-300 km^2);
- breaching of the hydrogeological regime, pollution of groundwater and surface water with complete degradation of rivers due to siltation and erosion of coasts, excess levels of water contamination;
- during the production of cement - water use and wastewater discharge.

4. Violation of subsoil during construction and operation of a plant for the extraction of mineral raw materials, characterized by violation of the integrity of the rock mass, withdrawal and loss of adequate resources.

Considering negative impact which is made by the cement industry on the environment, can be the main directions of greening: reduction of volumes of emissions by catching and utilization of dust, use of thermal energy of flue gases, alternative materials and fuel and others.

Savvin A., Khadzhinov E.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ASSESSMENT OF ABSORBED DOSE FROM IONISING RADIATION USING ELECTRON PARAMAGNETIC RESONANCE

Electron paramagnetic resonance (EPR) dosimetry is a physical method for the assessment of absorbed dose from ionising radiation. It is based on the measurement of stable radiation induced radicals in human calcified tissues (primarily in tooth enamel). EPR dosimetry with teeth is now firmly established in retrospective dosimetry. It is a powerful method for providing information on exposure to ionising radiation many years after the event, since the 'signal' is 'stored' in the tooth or the bone. This technique is of particular relevance to relatively low dose exposures

or when the results of conventional dosimetry are not available (e.g. in accidental circumstances). The use of EPR dosimetry, as an essential tool for retrospective assessment of radiation exposure is an important part of radioepidemiological studies and also provides data to select appropriate countermeasures based on retrospective evaluation of individual doses. Despite well established regulations and protocols for maintaining radiation protection dose limits, the assurance that these limits will not be exceeded cannot be guaranteed, thus providing new challenges for development of accurate methods of individual dose assessment.

EPR consists of the resonant absorption of electromagnetic energy at electron-spin transitions. A static magnetic field should be applied to resolve different electron-spin levels. Unpaired electrons of free radicals have spin equal to ½. In a magnetic field there are two magnetic levels, +½ and –½ with different energies. The transition between two these levels is possible under following resonance condition:

$$h\nu = g\mu_B B$$

where ν is resonance frequency, h is Plank's constant, g is the g-factor, μB is the Bohr magneton, and, B is the magnetic field induction.

The device for EPR registration is called an EPR spectrometer. Today, EPR dosimetry is a leading method for retrospective dosimetry of individual radiation exposures. The EPR method have its own advantages and disadvantages.

The pluses are:

- measuring of the volume of samples;
- dose reconstruction in distinctive tissues;
- dose reconstruction after long periods of exposure;
- dose reconstruction for many years after the exposure.
- And the minuses are:
- the difficulty in collecting material for analysis;
- reconstruction of the individual dose is complicated and labour-consuming.

Scherbovich A., Boyarkin O.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

PROTON AND ELECTRON ACCELERATORS IN THE TREATMENT OF ONCOLOGICAL DISEASES

At present electron and proton accelerators are widely used in the diagnostics and treatment of cancer. There exist electron and proton therapy. The former is applied in the treatment of superficial or subcutaneous diseases (skin cancer, clay pipe cancellation, intraoral cancer, cervical carcinoma, breast cancer), while the latter is more universal since it allows to work at any body depth (eye melanoma, brain tumor, cancer of the head and neck, spinal cord tumor, lung carcinoma, a tumor in the skull base, prostate cancer, pituitary cancer, liver cancer). The basic advantage of

proton therapy in comparison with electron therapy is that the major energy losses occur in the last millimeters of the proton run, before stopping (the Bragg peak). Location of the Bragg peak depends on the energy to which the particles were dispersed in an accelerator. Thus, by varying the energy of the protons, you can achieve maximum energy throughout the depth of the tumor with minimal damage to healthy tissue. This is especially important in the treatment of pediatric patients as possible to reduce the radiation exposure to the growing and developing tissues.

Accelerators which are used in medicine could be conventionally divided on two kinds. The first kind consists of accelerators that produce medical radioisotopes for the diagnostics of various organs and tissues. The second kind deals with accelerators that are exploited in direct treatment of cancer.

In this work we consider the operation principles of accelerators, their advantages and disadvantages as compared with other methods of cancer treatment. The review of accelerators operating in Belarus and Russia is also given.

Serzhantova E., Zhigalskaya A., Pinchuk E.

Gimnasium school № 43, Minsk, Republic of Belarus

PRAYING MANTID (MANTIS RELIGIOSA) IN BELARUS

The present time is characterized by an ecological trouble, one manifestation of which is the presence of invasive species, which substitute and even displace aboriginal species.

The analysis of literary sources on the problem of invasive species has shown that in recent years the praying mantid (Mantis religiosa) has been settled throughout the territory of Belarus. Its appearance is caused by climate change and the drying melioration of the Belarusian Polesye. As is known, low-lying swamps transformed in the process of drainage have ceased to serve as a barrier to the penetration of alien species. It has caused the penetration of steppe, semi-desert and even desert species including the praying mantid in the southern part of Belarus.

Objective: to trace the dynamics of the praying mantid settlement in Belarus and peculiarities of its biology under laboratory conditions.

1. To carry out the analysis of literature on the problem of invasive species.
2. To reveal habitats of the praying mantid in Belarus.
3. To reveal the phenoshape of the praying mantid from different habitats.
4. To study the trophic relationships of the praying mantid under laboratory conditions

Data on the distribution of the praying mantid throughout the republic have been obtained and analyzed. The first mention refers to the end of the 90 's, last century. In the XXI century the emergence of the praying mantid was registered as single individuals on the territory of the Polesye Radiation Reserve (near Babchin) in 2008, 2010. Currently it is widespread everywhere in the Republic. The latest find was registered in the north of Belarus (near Bercovichi). The greatest number of

finds fall on 2015–2016, i.e. the tendency of the increase of distribution speed is observed.

It should be noted that the mantises living on natural and anthropogenically modified territories have phenotypic differences (body color): green, yellow and brown. It is known that green individuals are commonly found on vegetating plants, and brown ones – on sun-bleached plants. According to our observations within Minsk brown individuals more often occur in the most urbanized parts of the city, and green and yellow individuals occur in the conditions close to the natural environment.

17 species of insects mainly pests of various cultures are given on http://www.ias.by about alien species. Among them different species of aphids, being a fodder object of the praying mantid, are dominated. To study the nature of the trophic relations of this species an experiment is being conducted on the basis of the Minsk Gymnasium school № 43. During the experiment the offspring has been received and the range of the praying mantid fodder objects has been defined. So, the adults feed on flies (Diptera) and their larvae, and the praying mantid nymphs feed on fruit flies (Drosophilidae) and aphids (Aphidodea), thereby bringing benefit.

Thus, the praying mantid can be used as a biological method of struggle, including greenhouses.

Shalkevich P.[1], Kundas S.[2], Moroz A.[1]

[1]*International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;*

[2]*Belarusian National Technical University, Minsk, Republic of Belarus*

COMPARISON OF MULTI-THREADING SIMULATION METHODS OF NON-ISOTHERMAL HEAT AND MOISTURE TRANSFER

Using of parallel computing technologies of modeling the non-isothermal heat and moisture transfer in soil is very important for improving obtained simulation results. In previous works the authors developed computational algorithms and methods which allow most effective solution of the task using High Performance Computing technologies. However, due to the computer resource requirements of the task solution, it is worth checking whether it is possible to further improve its performance metrics. Is it possible to speed up the task solution, using different software technologies in the context of the developed computational algorithms?

To date there are five software technologies which can be used to speed up calculations in modeling the non-isothermal heat and moisture transfer of contaminants in soil:

1) Intel TBB;

2) Intel Cilk Plus;

3) OpenMP;
4) C++11 Threads (similar to Boost);
5) Using Pthreads directly.

Considering that the developed algorithms and methods of parallel computing of the task of modeling the non-isothermal heat and moisture transfer of contaminants in soil are implemented in the SPS (Simulation Processes in Soil) software package which is based on C++ there is no need to use Intel TBB and Intel Cilk Plus technologies. Using Pthreads directly we can probably get some better results, but implementation of this software technology will take much more time than the worth of the result. Thus, we should compare OpenMP and C++11 Threads implementation. OpenMP framework has been already implemented by the authors unlike C++11 Threads. It is also interesting to use C++11 Threads because it is included in the current C ++ language standard ISO / IEC 14882: 2011.

To compare OpenMP and C++11 Threads frameworks an experiment was conducted. The simulation of non-isothermal heat and moisture transfer of contaminants in soil, at a distance of 10 meters from the source was made. The speed of calculations was measured with the use of *time* function (Table 1).

Table 1. – The results of calculation time comparison of compare OpenMP and C++11 Threads frameworks

OpenMP	C++11 Threads
real 0 m 7.438 s	real 0 m 8.588 s
user 0 m 3.828 s	user 0 m 4.616 s
sys 0 m 3.132 s	sys 0 m 4.176 s

In this article we had a closer look at possible frameworks for managing multithreading of simulation of non-isothermal heat and moisture transfer of contaminants in soil efficiently. We have seen that there are actually a variety of options, but OpenMP shows the best efficiency.

Sheiko A.

Belarusian State University, Minsk, Republic of Belarus

THE FIRST DATA ON SPECIES ANTHOPHILOUS INSECTS VISITING INFLORESCENCES OF ARUNCUS VULGARIS RAFIN. IN MINSK REGION (HYMENOPTERA, APOIDEA)

The study of the relationship between anthophilous insects and plants which they pollinate is becoming increasingly important. The obtained data allow us to estimate the role of insects in seed reproduction of plants and may indicate the role of plants as sources of nectar and pollen for anthophilous insects.

Aruncus vulgaris Rafin was selected as the object of research. This plant is dioecious herbaceous perennial plant from family Rosaceae with erect stem up to 2 m. The flowers are small, white and cream colored, collected in the sprawling panicle up to 50 cm long. It spread mainly in the mountains of Central and Southern Europe, number of species locations decreases on the European plains. It blooms from mid-June to early August. The plant is perspective for introduction into the culture as an ornamental, medicinal and honey plant. Species included in the Red Book of the Republic of Belarus.

The collecting of insects was carried out during flowering period of plants in June, 2016. Insects were caught in the vicinity of the reservoir "Drozdy", Minsk. Insects caught manually directly from the inflorescence of the plant. Then they were placed in plastic test tubes with an aqueous ethanol solution. The taxonomic identification has been done with the key.

As a result of research, 11 species of Hymenoptera have been registered on inflorescences of *Aruncus vulgaris*. *Andrena hattorfiana* Fabricius have been marked. This species belongs to family Andrenidae and it was registered on the inflorescences of *Knautia arvensis*, chicory (*Cichorium*), occasionally on flowers of Labiatae, Compositae, etc. Also from that family *Andrena humilis* Imhoff was marked (prefer plants of Compositae). Family Anthophoridae is represented by males of the species *Anthophora* sp., and also females of the species *Nomada emarginata* F. Mor. Unidentified species of genuses *Halictus* sp. and *Lasioglossum* sp. belong to family Halictidae. These species are polytrophic insects, pollinators of cultural and other household important plants. Family Melittidae represented by the species *Dasypoda plumipes* Panzer., which can be found almost exclusively on Asteraceae, and *Melitta tricincta* Kirby. Family Megachilidae is submitted kleptoparasite species *Coelioxys inermis* Kirby.

Thus, 11 species of anthophilous insects were registered as pollinators of *Aruncus vulgaris* for the first time. In the future we plan expand the study of taxonomic and ecological features of communities of insect which pollinate *Aruncus vulgaris.*

Shish A., Boyarkin O.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

INFLUENCE OF SOLAR ACTIVITY ON BETA-DECAY RATE

In this note we analyze the recent experiments on detecting the decrease of the decay rate of some beta radioactive elements. For the first time such data were obtained at Purdue University. Professor Jenkins, monitoring a detector in his lab (1 μ Ci sample of Mn-54), discovered that the decay rate of Mn-54 decreased slightly beginning 39 hours before a large solar flare of 2006 Dec.13. Since then, other researchers have been examining similar variation in the decay rates. For example, decreasing the decay rates were detected for the samples Cl-36 and Si-32 at the

Brookhaven National Laboratory, for samples Sr-90/Y-90 at the Moscow State University named after M.V. Lomonosov, for samples Ag-108, Kr-85, Eu-154, Ba-133, Eu-152 and Cs-137v at the German center PTB (Physikalisch-Technische Bundesanstalt). In the recent years a number of articles have been published presenting evidence that some beta decay rates are variable and this changeability may be connected with behavior of the solar neutrino flux (hypothesis of the ν_e –induced beta decays).

We remind that the solar flares (SF) represent itself the most powerful of all the solar activity events. The energy released during the SF is about $10^{28} - 10^{32}$ erg. It is now widely accepted that the magnetic field provides a main energy source of the solar activity including the SF's.

From point of view of many researchers such variations are connected with the decrease of the electron neutrino flux which is born in the deep solar interior. We investigate the motion of the neutrino flux in the solar matter and twisting magnetic field. Our consideration carries general character, that is, it holds for any standard model extensions with massive neutrinos. We find out the factors which influence on the electron neutrino flux, crossing a region of SF. When the SF is absent a terrestrial detector records the electron neutrino flux weakened at the cost both of vacuum oscillations and of the MSW resonance conversion only. On the other hand, the electron neutrino flux passed the SF region in preflare period proves to be further weakened in so far as it undergoes one (Majorana neutrino) or two (Dirac neutrino) additional resonance conversions, apart from the MSW resonance and vacuum oscillations.

We also consider the hypothesis of the ν_e – induced decays which states that decreasing the beta decay rates of some elements of the periodic table is caused by reduction of the solar neutrino flux.

Staradynay A.

Belarussian State University, Minsk, Republic of Belarus

POLYFUNCTIONAL PHYSIOLOGICAL EFFECT OF NITRIC OXIDE IN MODERN RESEARCH

The problem of the synthesis of nitric oxide (NO) has attracted the attention of biologists in 1916 in connection with the formation of the body of nitrates and nitrites. Analysis of the literature of the twentieth century suggests that a study of NO , cover a large area at the junction of biochemistry and molecular biology. Modern understanding of the regulation of cellular processes allow to allocate multifunctional physiological effects of nitric oxide, as the free radical is able to provide the activating and inhibitory effect on different metabolic processes in mammals and man.

Nitric oxide - a gas well known to chemists and physicists has recently attracted the attention of biologists and physicians. Intensive study of the biological effect of

NO started with the 80-ies, when R. Furchgot and J. Zawadzki showed that the expansion of blood vessels under the influence of acetylcholine occurs only in the presence of endothelial-epithelial-cells lining the inner surface of all blood vessels. Substance secreted by the endothelial cells in response to not only acetylcholine, but also on many other external factors, leading to vasodilatation, has been called "endothelial vasodilator factor". Later, it was proved that the substance is NO gas and the cells are specific enzyme systems capable of synthesizing it.

Studies conducted in 1986 - 1989, it was found that nitric oxide is synthesized in the vascular epithelium and spreads to the adjacent smooth muscles, causing them to relax . According to their chemical structure related to the nitrogen oxide neutral diatomic molecules. Due to the presence of an unpaired electron in the outer orbital of π-molecule NO is highly reactive and free radical properties.

To date evidence accumulated so much that is not yet understood, even overall pattern produced by them. In the body, nitric oxide is produced by oxidation of L-arginine amino acid with simultaneous synthesis of different amino acids under the influence of the citrulline enzyme NO-synthase. The enzyme was named synthase instead synthetase, since its operation is not required ATP energy. Nowadays we studied:

a) macrophage NO-synthase, which has a cytotoxic effect or a microbicidal;

b) endothelial NO-synthase, the main role, which is that NO is a potent vasodilator agent and is involved in the regulation of the cerebral circulation.

Susha A., Mitsura D., Lopatin V., Handogiy A.

Belarusian State University, Minsk, Republic of Belarus

ASSESSMENT OF ANTHROPOGENOUS INFLUENCE ON AMPHIBIOUSES OF THE MINSK DISTRICT DURING THEIR REPRODUCTION

Due to the active growth of the urban population, especially acute raises question of the conservation of biodiversity in urban areas. This is especially important for amphibians, which are very sensitive to the manifestation various kinds of human activities. Because of it, the decision of any questions related to their present range, as well as natural and anthropogenous conditions in which these animals change their morphological and genetic indicators is of great importance for the theoretical and practical biology. The purpose of research - to identify the impact of urbanization on amphibian populations Minsk region during their breeding – the most vulnerable period of their life cycle.

The material for the writing of this paper were the results of field research in 2016 (April), held on the pond in the village Schomyslitsa Minsk district area of 952 m². Censused of amphibians conducted by routing method in the period of greatest activity of amphibians (Handogiy, 1995). Features amphibian reproduction were studied by well-known population parameters (Bannikov et al. 1978).

Species diversity of amphibians in the spawning ground in the village Schomyslitsa limited to 3 types.

Gray toads dominated (97,2%) while of outsiders – the moor frogs and green toads was the share only 2,0 and 0,8% respectively dominated. Emergence of amphibiouses on a spawning area wholly depended on weather conditions. In a clear weather, at a temperature from 9 to 13 °C, moderate humidity and pressure, the greatest number of species of Amphibia was observed. Population density of amphibiouses on a spawning area was very low and made 0,26 individuals on 1 m².

The analysis of features of manifolding of amphibians showed that the index of density of layings of caviar on 1 m² a reservoir in a reservoir of of Shchomyslits makes about 0,99. In the territory of all spawning area only seven places with the postponed layings of caviar of an moor frog were revealed. In process of increase in air temperature, the quantity of layings of caviar increased and by the time of the end of spawning made 111. All layings of caviar of gray and green toads were found in 4 places practically in a northern part of a reservoir.

It is well-known that during migration of an amphibian are more subject to anthropogenous loading (Pikulik, 1985; Handogiy, 1995). By us it is established that of 1500 m of Highway Shchomyslits – Minsk was the share about 236 frogs who died under wheels of the motor transport. In separate years of the current century (2006) here on the road about 350 frogs perished (the oral message A. V. Handogy). The index of density of the died amphibians on this highway made 0,46 frogs on 1 meter (2016).

Thus, absence in city landscapes of the favorable reservoirs for manifolding results in high concentration of amphibiouses on simple spawning areas and as a result – to their high death on roads at migration to them.

Talkach G., Poznyak S.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

INFLUENCE OF MINERAL FERTILIZERS ON HEAVY METALS ACCUMULATION IN SOILS

Besides main components of fertilizer (batteries) their composition usually contains heave metals and metalloids impurity. Their content degree depends on quality of feed stock and its processing technology. Heavy metals and arsenic concentration in nitrogenous and potash fertilizers is low. These fertilizers also can contain some not big impurities of Mn, Cr, Ni, Zn, Ti – up to 100–400 mg/kg, as well B – up to 50–60 mg/kg. Phosphoric fertilizers (table 1) are most enriched with chemical elements impurities.

Table 1. – Impurity level in superphosphates, mg/kg

Impurity	Contents	Impurity	Contents
Arsenic	1,2–2,2	Lead	7–92
Cadmium	50–170	Nickel	7–32
Chrome	66–243	Selenium	0–4,5
Cobalt	0–9	Copper	4–79
Vanadium	20–180	Zincum	50–143

By mineral fertilizers dose of 109 kg/hectare of NPK about 7.87 g of Cu, 10.25 – Zn, 0,21 – Cd, 3,36 – Pb, 4,22 – Ni, 4,77 – Cr come into the soil. According to TsINAO, 3200 t of Cd, 16633 t of Pb and 553 t of Hg were brought in soils during entire period of phosphoric fertilizers use in former USSR. The majority of chemical elements got into soil is in low mobile state. Cd half-life elimination is 110 years, Zn – 510, Cu – 1500, Pb – several thousands of years. By long time using (more than 70 years) of mineral fertilizers on soils with naturally low heavy metals content does not lead to achievement in them extreme or approximately admissible levels of metals concentration. But even in these cases somw species of crops, especially their vegetative parts, may contain metals and metalloids at MAC level. It can be linked with broader fertilizers effect onto «soil-plant» system. Mineral fertilizers using in soils naturally enriched by heavy metals can lead to metals accumulation in agricultural plants above MAC. Negative effect of systematic fertilizers use for plants can be caused by soil solution acidifying that increases mobility of heavy metals compounds and leads to change of microorganisms species structure. To prevent soil acidifying it is affected by lime application, but heavy metals get into soils as well as lime part (table 2).

Table 2. – Content of heavy metals in fertilizers and a lime, mg/kg

Type of the fertilizer	Zn	Cu	Ni	Pb	Fe
Potassium chloride	3,11	8,67	4,33	8,67	680,53
Ammonium nitrate	0,20	0,25	0,84	0,05	603,00
Lime	10,83	12,67	26,00	26,50	4853,00

It is difficult to set limits of safe maintenance for each element in the soil. Elements toxicity degree depends on granulometric composition of soil, its acidity, humus content, plants species and etc. If crop reduces productivity to 5–10% by presence of some metal, therefore its level content is considered as toxic. Thus, heavy metals balance calculation allows to determine ecological situation condition concerning heavy metals pollution of soils and gives scientifically based forecast about possible deterioration danger in situation as mineral fertilizers are not only a source of metals in agroecosystems, but also powerful tool of their cycles intensification.

Tsybulko D.
Belarusian State University, Minsk, Republic of Belarus

TAXONOMY LIST OF HYMENOPTERA VISITORS OF *COSMOS BIPINNATUS* INFLORESCENCES IN BELARUS

Studying of anthophilous insects has a great importance as they let the cross-pollination process to occur. Consequently pollinators provide the seed production process occur effectively. One can't deny that reproduction process of the majority of flowering plants is dependent on anthophilous insects. Native agricultural plants being pollinated by insects fruit well and there is no problems with symbiotic relations between plants inside phytocenosis. But when it comes to plants being introduced in our phytocenosis the importance of studying of symbiotic relations between plants and their pollinators becomes obvious. As the introduced species could be more competitive as native plants this introduction could lead to rearrangement of structure of whole phytocenosis. In this way the relevance of such researches is obvious.

So the research goal is to identify the taxonomy list of Hymenoptera visiting the inflorescences of *Cosmos bipinnatus* in Belarus.

Cosmos bipinnatus Cav. is annual plant. Height is about 1,25 meters. Flowers form large inflorescences located on the top of the stems. Central flowers are bisexual and colored yellow. Peripheral flowers (7 or 9 flowers per inflorescence) are colored red or white. Flowering lasts from July till October. *Cosmos bipinnatus* is a striking example of introduces species widely used as ornamental plant.

The collecting of insects was held during July 2015. Insects were caught on the territory of Leshnitsa village (Berezino district, Minsk region, Republic of Belarus). Insects were caught by hands while visiting the inflorescence of *Cosmos bipinnatus.* The taxonomic identification has been established with the key.

During the research we have registered 4 species of Hymenoptera as the visitors of inflorescences of *Cosmos bipinnatus.* Representatives of all 4 species are polythrophic pollinators of flowering plants. These species are listed in the following table.

Table 1. – Taxonomy list of Hymenoptera visitors of inflorescences of *Cosmos bipinnatus* Cav.

Family	Species
Apidae	*Apis mellifera* L.
	Bombus agrorum Fabricius
	Bombus lapidarius L.
Halictidae	*Halictus sexcinctus* Fabricius

All of these species were registered as the visitors of the inflorescences of *Cosmos bipinnatus* for the first time in Belarus.

In this way there were 4 species of Hymenoptera registered as visitors of inflorescences of *Cosmos bipinnatus* Cav. in Belarus. These species belong to Apidae and Halictidae families. All of these species were registered as the visitors of the inflorescences of *Cosmos bipinnatus* for the first time in Belarus.

Viarenich K., Makarevich K.

Institute for nuclear problems of Belarusian state university, Minsk, Republic of Belarus

X-RAY DETECTORS USED FOR SIGNAL DETECTION IN COMPUTED TOMOGRAPHY

We consider detecting system in X-ray Computed Tomography (CT) is modelling of X-ray transport in the body of patient who undergoes CT examination.

Multislice spiral CT contain several rows of detectors. There are 512 to 1024 detectors in the rotation plane. Therefore the field size is 50 to 70 cm. There are 16 to 64 detectors in transverse plane, therefore field size is 0,2 to 4 cm.

Material is chosen based on the sensitivity of to different energies in X-ray spectrum. This characteristics of a material can be seen on a graph showing the dependence of cross-section of interaction of radiation with matter on energy. This dependence is not monotonic for low-energy radiation. Photoeffect is the main physical effect that occurs at these energies. This effect takes place when X-ray quantum transfers all its energy to a electron from one of electron shells. If the energy of electron of the electron shell (i.e. K-shell) is greater than the energy of X-ray quantum, the photoeffect is not possible. This effect is seen from the jump of cross-section at this energy (K-border). Different substances have different values of K-border. Different sources of literature state that depending on a particular X-ray detector material the value of K-border (or several K-borders if present) may significantly affect the effectiveness of absorption.

The typical detector material of CT is Gd_2O_2S. The thickness of the detector is 1 to 1,4 mm. Detectors are separated by Ta plates 100 um each. These plates lead to fall of effectiveness of registration by 20–30%. To solve this problem recently they suggest using such active substances as CdTe in detectors. Active substances transfer X-ray radiation directly into electric charge. This charge is collected for about 1 ns, that gives the possibility to detect single photons and even measure their energy.

Some CT produced by General Electric have working substance named Gemstone. CT scanner GE HiSpeed X/iF uses ceramic scintillator Highligh ($Y_2Gd_2O_3$:Eu).

Modern CT can produce images with the resolution of 512×512 pixels. The resolution of the image is increased by interpolation for better comfortable analysing.

There are four main generations of CT based on the detecting system position. An older "third" generation had detectors were situated in an arc that rotated with the same speed as the source. Currently this generation is most popular. The detec-

tors of fourth generation CT systems are fixed in space. This variant of detectors provides better signal registration.

Characteristics of detecting systems in CT may be improved by development of computer technology, new signal detection systems and other advances.

Zagortseva E., Asipchyk M., Golubev A.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

GROWTH ASTACUS ASTACUS IN EXPERIMENTAL CONDITIONS AT DIFFERENT PLANTING DENSITIES

The aquaculture of crawfishes within long years developed in the countries with tropical and subtropical climate, but in midlatitudes industrial cultivation of hydrobionts takes quite modest place. Value of an aquaculture for Belarus which doesn't have an entry in the World Ocean, but possessing a significant amount of internal reservoirs is especially big. In our country their cultivation at the moment wasn't beyond researches.

The success of rearing juvenile crawfish in aquaculture is determined by many factors: quality of the water environment (temperature, pH, oxygen mode, purity of water, photoperiod, etc.), quality of a forage and diet, control of diseases, sizes and age of individuals and density of their landing.

For studying of growth of wide-brimmed cancer (Astacus astacus) at the different density of landing in vitro the juveniles of cancer were divided into control groups.

Further crayfish for convenience of carrying out experiment on dwelling in case of group landing were divided and placed in 3 aquariums, everyone in amount of 7 l. In an aquarium No. 1 5 individuals, in an aquarium No. 2 – 10 individuals, in an aquarium No. 3 – 19 individuals were replaced. Other larvae, in number of 10, put in separate glass reservoirs in amount 1 l for studying of density of landing in case of single dwelling.

At the age of 3 months the average mass of all 10 individuals in case of single landing constituted 283,1 mg, in 6 months – 452,5 mg, in 7 months – 488,5 mg, in 8 months – 625,9 mg. Further results for individuals in 3 aquariums in case of group landing are shown. At the age of 3 months average weight constituted 289,9 mg, in 6 months – 450,1 mg, in 7 months – 563,1 mg, in 8 months – 759,5 mg.

Researches showed that the number of the individuals who are in one reservoir influences death rate of crayfish. The more individuals is in one reservoir, the death rate is higher. From 10 individuals who lived one by one only 1 cancer died.

At the increased landing density final weight indicators were higher, than in case of lower. At the low density high survival and increase in weight, rather independent of density, are noted. In the conditions of the increased landing density

growth of individuals leads to gradual exhaustion of resources of living floor space for them that is a powerful limiting factor.

The obtained data can be used for further studying of features of growth of wide-brimmed cancer at the different density of landing in vitro.

Zaranko M., Golovatyi S.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

METHODOLOGICAL APPROACHES OF CALCULATION OF ECOSYSTEM SERVICES

It is necessary to understand all range of goods and the services provided by the nature as ecosystem services. On the existing classification the services provided by ecosystems can belong to one of four broad categories which in essential degree match functions of the natural equity. They include the providing, regulating and cultural services which directly influence people, and also the support services necessary for preserving other services.

Now in the world development of a wide range of the questions connected with ecosystem services including their assessment, determination of potential sellers and buyers and mechanisms of compensation, forming of the markets of these services actively begins. Ecosystem services include the resource, regulating, cultural and other services and are determined as benefits which people receive from ecosystems. The kyoto protocol, to some extent, became the first attempt of the world community on a global scale to include ecosystem services (including payments and compensation to the certain countries) in the international and national economic mechanisms for fight against climate change.

It is necessary to begin development of ecoservices with identification, further accounting and assessment – on the basis of the analysis of extent of degradation and a possibility of recovery of ecosystems. The list will include the processes of agriculture, livestock production, fish breeding, collection of officinal herbs and seaweed supporting and regulating the cultures, etc. occurring in the territory of Belarus.

In case of assessment of ecosystem services study their role, a complex of technological and economic measures for accounting of some types. Only in case of complete understanding of a question it will be possible to adjust accounting, statistics, planning. It isn't excluded that entering of certain quotas, an incentivization will be required, changes in the taxation – are possible provided that ecosystem services will be entered into the field of state regulation and the legislation of Belarus. It is necessary to understand that development of ecosystem services adjoins to economy and shall be considered in the economic block of the National Sustainability Strategy (NSS).

Ecosystem approach represents the strategy of integrated management of land, water and live resources which stimulates their preservation and steady use on a fair basis.

Traditional approach to assessment of ecosystem services in nature protection activities is the value assessment of preserving a biodiversity in especially protected natural territories (EPNT). A benefit of this approach is not only a capability to characterize uniqueness and biological diversity of ecoservices of the protected territories, to give them an economic evaluation, to determine benefits and possible losses, but also to develop the principles of preserving the services provided by ecosystems. The main lack of approach consists that efficiency of EPNT is limited to isolation and the small area of the territories, thus it is impossible to estimate a full range of ecosystem services. With respect thereto, the main attention is paid to preserving a biodiversity outside EPNT.

Zhukava H., Panko A., Kryuk D.

Belarusian State University, Minsk, Republic of Belarus

REED PARAMETERS IN THICKETS OF DIFFERENT DENSITY IN NAROCH LAKE

Naroch Lake is a meso-oligotrophic polymictic lake, which face and functions are significantly influenced by macrophytes. Wide littoral zone, which takes near half of lake's square and high water transparency create fine conditions for water plants to grow. In the shallow water zone of littoral reed beds have the greatest values of biomass and density (Zhukava et al., 2005). Reed grows along the coastline, in some places going 200 meters into the lake from the coast. Those thickets are not continuous. They form sites of different size and density which take in total nearly 20 % of the shallow water zone – the territory from the coastline to isobath limiting 2 m depth (Zhukava et. al., 2009).

The paper is aimed at assessment of reed growth and weight parameters in thickets of different density in the shallow water biotopes in the littoral zone of Naroch Lake.

The studies have been carried out on the premises of the Educational and Research Centre «Naroch Biological Station named after G.G. Vinberg» in July 2016. The investigated part of the coastline stretched from the Biostation to the sanatorium «Naroch» (near 4 km). For sampling we chose biotopes with different density of reedbeds. Reed stems were cut at the ground level using 0,25 m^2 frame. We took from 3 to 11 samples depending on thickets density so the number of stems in one biotope was more or equal to 30. Depth at the measured sites ranged around 0,3–0,5 m. In the collected samples we measured the number of stems, their length and diameter (at the bottom part), wet and air-dry weight (table 1).

Table 1. – Size and weight parameters of reed in biotopes of different density (average values ± standard deviation and min-max are given)

№ of biotope	Density, ind./m^2	Number of stems	Wet weight (**I**), g/m^2	Air-dry weight (**II**), g/m^2	(I)/(II)	Stem length, cm	Stem diameter, cm	Part of regrowth, %
1	48 (28–84)	38	898,3 (360-1770)	212,7 (140-264)	0,24	188±58 (84-290)	0,70±0,22 (0,35-1,1)	18,4
2	78 (48–104)	68	1075 (840-1220)	477,3 (360-586)	0,44	221±54 (102-294)	0,74±0,19 (0,25-1,3)	1,5
3	37 (20–60)	33	243,3 (185-355)	127,3 (78-200)	0,52	163±38 (93-221)	0,53±0,08 (0,35-0,7)	0
4	123 (68–216)	55	640 (570-725)	265,7 (222-303)	0,42	202±35 (124-271)	0,59±0,12 (0,30-0,8)	0
5	126 (68–216)	106	1533,3 (1425-1650)	656,7 (630-680)	0,43	249±31 (165-305)	0,70±0,13 (0,40-1,0)	0
6	16 (8–40)	41	39,1 (20-65)	16,8 (5-30)	0,43	96±32 (35-168)	0,32±0,11 (0,15-0,6)	41,5
7	30 (20–32)	42	178,3 (130-250)	93,9 (59,9-166)	0,53	174±39 (85-272)	0,64±0,14 (0,35-1,0)	11,9
8	15 (12–20)	30	105 (60-195)	46,2 (25,31-66,9)	0,44	175±45 (68-268)	0,62±0,17 (0,30-1,0)	20,0

Depending on the thickets density, reed's weight in the samples was quite different, whereas average weight of one stem was 35,0 g/ind. in wet weight (15,5 g/ind. in air-dry weight).

Average length of stems was different among the biotopes, while thickets of higher density had higher size and weight parameters of stems. Part of regrowth (young stems shorter than 1 m) at some sites was up to 20% and in average for all studied biotopes was 8,7%.

Presented data allow us to judge about the spatial distribution of reed at the measured site of littoral. It also can be used when calculating the reed production and square of plant substrate for periphyton.

The investigation was partly supported by Belarusian Republican Foundation for Fundamental Research.

Zhuravkov E., Kapitsa V.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

IDENTIFYING THE DISTRIBUTION OF AIR POLLUTION DEPENDING ON THE DISTANCE FROM THE ROAD BY LICHENOINDICATION

The lichens' sensitivity is useful bio indicators for air pollution, especially sulfur dioxide pollution, since they got their water and essential nutrients mainly from the atmosphere rather than from the soil. It also useful they ability to react to air pollutants all year round. The lichens can be used for air quality assessment without complicated equipment.

In our investigation we made an evaluation of lichen development in Loshitsky park (Minsk) with different distance from the road. Adequate evaluation can be obtained only by using the same variety of trees in all experimental plots. Maple was chosen as the most populated lichens.

The traditional method of the lichenoindication was used for identification of the index for relative purity of the atmosphere. The index for relative purity of the atmosphere (*RPA*) was calculated through assessment of results of lichen development on all five specious of the trees accordingly the form:

$$RPA = \frac{3 * B + 2 * F + S}{30 * L};$$

where B – length bushy lichen; F – length foliated lichen; S – length scale lichens; L – circumference of the tree.

The following table shows the differences in the relative purity of the atmosphere maple, depending on the distance.

Table 1. – Changes in the relative purity of the atmosphere of the index depending on the distance

№	Distance	*RPA*
1	50 м	0,0285
2	25 м	0,0325
3	5 м	0,00086

As a result of experimental and computational work, it was proved that the atmospheric air is reduced depending on the distance.

SECTION 4

CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT. RENEWABLE ENERGY SOURCES AND ENERGY CONSERVATION

Artsiamchuk S., Pashynski V., Uzgorok M.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ENERGY EFFICIENCY OF SMALL HYDRO POWER PLANT ON WATER OUTLET OF MINSK SEWAGE TREATMENT PLANT

Small hydropower plant is located on the territory of Minsk sewage treatment plant UE "Minskvodokanal". It is used as an electric power source by converting energy of water which is formed by difference of levels between upstream and downstream of water outlet of Minsk aeration station. Upstream is culvert tray of Minsk aeration station, downstream is filtering part of treated wastewater.

Water intake, feeding canal tract and turbine hall of hydro power plant on water outlet don't affect on existing operating conditions of Minsk aeration station. The layout of equipment and building solutions are implemented by project taking into account existing building structures situation of water outlet and easy maintenance during operation.

Project calculation was made according to data which were presented by UE "Minskvodokanal". According to Minsk sewage treatment plant data after commissioning of second turn of Minsk aeration station average daily flow of treated water in considered alignment decreased. He was approximately 5 m^3/s. Maximum average hourly design flow rate is 7,8–9,3 m^3/s, minimum average hourly design flow rate is 2,5 m^3/s.

Throughput of water-supply system of hydro power plant and hydrounits of small hydro power plant is designed for a maximum expenditure 10 m^3/s.

Reset mode of treated water is due to work of station. It varies depending on day of week and time of day. It cannot be predicted in advance with high accuracy that's why hydro power plant have to work in watercourse mode and have to be able to respond each time to change of consumables mode.

The purpose of research is to assess the energy efficiency of small hydro power plant on water outlet of Minsk sewage treatment plant.

Head (including losses) is assumed to be 7,0 m.

The annual hydropower potential in accordance with calculated data amounts to 2,4 million kW h. Daily power value of hydro power plant varies from a minimum 137 kW to maximum 520 kW. For considered case installed capacity of equipment

of hydro power plant is taken equal to 500 kW. Energy production is approximately 2.4 million kW h. Conventional number of work hours with installed capacity is approximately 4800 hours. It will make savings about 270 tons of equivalent fuel and can significantly reduce the amount of harmful emissions into the atmosphere.

The paper presents the actual performance. Based on them graphs for determining energy efficiency of small hydro power plants are made.

Bereshkova E.

The Center of Hydrometeorology, Radioactive Contamination Control and Environmental Monitoring of the Republic of Belarus, Minsk, Republic of Belarus

FOREIGN AND DOMESTIC EXPERIENCE IN THE APPLICATION OF METHODS OF RADAR SENSING AND RADAR COVERAGE AREAS FIELD

With the development of technologies in the field of civil aviation and soaring air traffic, it is most important to the efficiency of the actual and forecast weather information. Dangerous weather phenomena bring huge economic losses, more importantly, take away human lives. Most hazards to civil aviation are shower rain, thunderstorms, hail, squalls. To monitor changes in the weather and the analysis of its state at a particular period throughout the globe a network of meteorological stations was created.

Of particular difficulty is the forecast of convective phenomena (storms, shower rain, hail, squall), where dozens of the scale – a few hundred kilometers. These phenomena are associated with cumulonimbus clouds (Cb). The main source of information about the spatial distribution of convective phenomena is the weather radar (MRL), which allows to detect pockets of convective phenomena in a radius of 350 km from the MRL. These radar observations of MRL warn about the appearance of convective phenomena with a lead time of 1–3 hours and several MRL, a review of which overlap each other, make it possible to predict such events for up to 12 hours.

Currently MRL are widely used all over the world. They have an extensive range of features and adapted to the needs of a specific country (table 1).

Table 1. – Word radars

s/n	Country	Name radar	Destination
1	United Kingdom	Siemens Plessey 45C	Precipitation Measurement for flood prediction and forecast
2	USA	WSR-88D	Storm warning and meteorological services
3	Germany	DWD	monitoring of weather phenomena and providing hydrometeorological information of water management and aviation services
4	Italy	ALENIA-SMA, EEC-ERICSSON	diagnosis and prognosis of catastrophic rains
5	Canada	WSR-88D	definition of cloudiness, precipitation, etc.
6	Japan	Mitsubishi	measurement of precipitation forecast for flood and regular water regime in the operation of dams on mountain rivers
7	Russia	MRL-2, MRL-5, DMRL-S	storm warning and meteorological support of civil aviation and hydrometeorological service
8	Belarus	MRL-5, DMRL	meteorological support of civil aviation and hydrometeorological service (Figure 1)

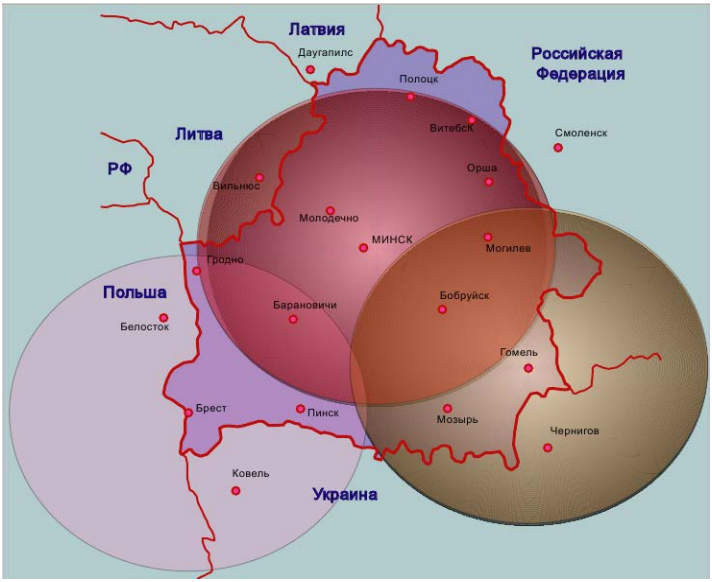

Figure 1. – The radar field on the territory of the Republic of Belarus

Dedkova E.[1], Lyach Y.[2]

[1] International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;

[2]GNPO "SPC of NAS of Belarus on bioresources", Minsk, Republic of Belarus

ECOLOGICAL AND HISTORICAL ASPECTS OF TRICHINOSIS IN GOMEL REGION

Trichinosis is a disease that develops on the average in 2-4 weeks after using infected meat. The degree of severity of illness for people varies from easy forms to severe complicated forms, sometimes it can lead to death.

Trichinosis of pigs is an asymptomatic zoonotic disease of pigs, caused by the shallow eelworms of *Trichinella spiralis* type. The sources of causative agent are more than 60 types of the animals infected with the larvae of trihinella.

The all-round study of problem of trichinosis in the Republic was conducted by such prominent helminthologists as: K. I. Skryabin (1928), Ch. S. Goregliad (1966), A. S. Bessonov (1964, 1972) and others. A. S. Bessonov (1972) marked that the numerous cases of pig helminthism and frequent incidence of the disease among the population was the main reason to serious study of all possible aspects of the problem of trichinosis in the Republic of Belarus.

First time the invasion was found during the examination at the inspection of pork carcasses in 1897–1912 in Minsk and Minsk province (D. P. Byalyatski, 1958). L. P. Chistyakov reported about pigs trichinosis when found out this disease in Vetka (1911), Zhlobin volosts of the Gomel district (Ch. S. Goregliad, 1966), but the invasion attracted special attention of specialists in 1925 in connection with the increased number of cases. In 1928, the All-Belarusian conference of medical and veterinary specialists was held. During this conference the experts discussed the measures of fighting against trichinosis and marked that in Gomel, Zhlobin and Rogachev districts 2.7% of pigs carcasses were staggered by trichinella. In the same districts the research workers of VIGIS under the direction of K. I. Skryabin found out that domestic carnivorous and marine rodents were infected with trichinosis.

Undertaken studies gave an opportunity to find out the reasons of human trichinosis and allowed to clarify the trichinosis situation in the indicated districts. Also during this conference, the practical measures on fighting against trichinosis were discussed. However, in subsequent years, these measures were not conducted and trichinosis hearths remained not revitalized.

Most difficult situation was observed in cities: Zhlobin, Rogachev, Terekhovsky, Mozyr, Rechitsa and Khoiniki districts. Some districts (Zhlobin, Rogachev) stayed adverse from 1911. The outbreak of trichinosis invasion among the population in 1926–1928 was caused by the use of pork meat infected with trichinellas. The diagnosis of this illness was set by the experts of VIGIS under the direction of academician K. I. Skryabin (P. M. Yamschikov, 1967).

During the Great Patriotic War, the trichinosis situation was worsening. From 1945 to 1956 trichinosis of pigs was registered almost in all districts of the Gomel Region. According to the official data from 1948 to 1963 (15 years), 1118 persons in the Gomel area were infected with trichinosis. Percentage of scope researches of meat of pigs received from the population in those years was from 5 to 18.

In subsequent years, conducted work on the exposure of trichinella in pigs along with the elucidative activity among the population by medical and veterinary specialists, allowed to conduct laboratory examinations of 75.8% meat of pigs till 1963.

During the period from 1960 to 2013 (53 years) in the region, 1892 cases of the clinically evident cases of human trichinosis were revealed – 24.8% of all registered diseased for this period in the republic. From all carcasses of domestic pigs infected with trichinosis for the period from 2009 for 2011 in Belarus 45.5% were relating to the Gomel Region. (L. S. Tsvirko, E. I. Narolenkova, 2014).

Epizootic situation on trichinosis of pigs in the Gomel Region as well as in Belarus as a whole constantly is under intent control of veterinary services. Only the veterinary laboratory of central market in Gomel in 2013–2015 conducted trichinelloscopy of 8307 carcasses of pigs and 37 carcasses of nutrias. In 2 tests of meat from pigs the larvae of trichinellas are found. Starting from 2013 and till the present time in Belarus in connection with the threat of African pig plague, the measures are conducted on thereduction of quantity of wild boar in the hunting sectors of Belarus. For this period the indicated laboratory conducted trichinelloscopy of 653 tests of meat of wild boar obtained in the hunting sector of the Gomel Region. From them one carcass was infected with the larvae of trichinellas.

Grinek A.[1], Lyakh Y., Vostokov E.[2], Fomchenko I.[3]

[1] International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus;

[2]SSPA "SPC of NAS of Belarus for bioresources", Minsk, Republic of Belarus,

[3]Vitebsk State Academy of Veterinary Medicine, Vitebsk, Republic of Belarus

CARRIAGE OF OPPORTUNISTIC BACTERIA INTO WILD WATERFOWL IN MINSK AND SMOLEVICHI DISTRICTS OF THE REPUBLIC OF BELARUS

The Republic of Belarus is a country having about 11 thousand lakes. The length of the rivers that flow in Belarus is about 90 thousand kilometers. Widely developed network of drainage canals and artificial water-bodies allows to represent country as the regional supplier of fresh water. All of these water objects in abundance inhabited by numerous species of waterfowl.

Actively operating structure of hunting sectors in Belarus allows to use this resource of waterfowls quite productively. Annually 100 thousand individuals are engaged in harvesting 600 thousand mallard ducks.

At the same time, according to the National Statistics Committee of Belarus, the number of poultry in the greatest farms of the Republic in 2016 grows up to 43646.8 thousand ducks. Existing hazard of infectious diseases among poultry can cause enormous damage to the national economy. In this regard, monitoring carriage of pathogens of bacterial infections among wild waterfowl, as potential sources of disease, is significance needed.

In order to establish carrier pathogenic and opportunistic pathogens, bacterial infections were carried out in laboratory conditions. 19 wild mallards (*Anas platyrhynchos*) were taken from the water-objects of Minsk and Smolevichi districts.

In the process of bacteriological tests carried out in Institute of Applied Veterinary Medicine and Biotechnology ("State Academy of Veterinary Medicine", Vitebsk) the following pathogens were isolated: *Escherichia coli, Yersinia enterocolitica, Citrobacter diversus, Enterobacter aerogenes, Salmonella, Staphylococcus aureus, Pasteurella haemolytica, Streptococcus zooepidemicus, Klebsiella oxytoca.*

It should be noted that this region is inhabited by 23 species of birds from 6 orders: order Anseriformes - mute swan *(Sugnus olor)*, eurasian wigeon *(Anas penelope)*, teal *(Anas sressa)*, mallard vulgaris *(Anas platyrhynchos)*, teal-treskunok *(Anas querquedula)*, shoveler (*Anas clypeata*), gray duck (*Anas strepera*), redheads duck (*Aythya ferina*), tufted duck (*Aythya fuligula*), goldeneye common (*Bucephala clangula*), merganser (*Mergus sp*.); order Gruiformes - coot (*Fulica atra*); moorhen (*Gallinula chloropus*); order Charadriiformes - blue-gray gull (*Larus canus*), black-headed gull (*Larus ridibundus*), river tern (*Sterna hirundo*); order Podicipediformes - great crested grebe (*Podiceps cristatus*); order Pelecaniformes - great cormorant (*Phalacrocorax carbo*); order Ciconiiformes – grey heron (*Ardea cinerea*), great white egret (*Egretta alba*); order Ciconiiformes – the white stork (*Ciconia ciconia*), bittern (*Botaurus stellaris*), little bittern (*Ixobrychus minutus*).

These species, along with mallards, may carry pathogens.

Waterfowl are carriers of a wide range of bacterial diseases pathogens, and in our case it was shown that ordinary mallard (*Anas platyrhynchos*) needs for more in-depth study in terms of waterfowl carrying bacteria.

Ivanova E., Pashynski V., Butko A.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ENERGY EVALUATION OF OPERATION BOILER JSC «PEAT BRIQUETTE PLANT "LIDSKIJ" WITH RESEARCH OF FUEL BASED ON "PEAT-WILLOW"

The problem of energy supply in the nearest future will become one of the most significant both at the global and local level especially for countries limited in its own resources. Rising rates of fossil energy consumption and their limited stocks force many European countries to develop national programs aimed at finding new energy sources. One such source can be wood of growing varieties providing biofuel output to 3-4 years from beginning of planting of production plantation. In our latitudes there are willows, aspens, poplars. So in Belarus within the framework of Resolution of Council of Ministers "On approval of National Programme for development of local and renewable energy for 2011–2015" dated 10.05.2011, № 586 creation of forestry organizations in addition more than 1 thousand hectares (2011–1176.2 ha) plantations of fast-growing wood and shrub species for fuel and energy purposes are provided.

The interest in fast-growing tree plantations to a large extent is caused by their high environmental potential. During growth trees provide oxygen production and carbon dioxide absorption, which is released by biomass burning in amount equal absorbed during growth. It means that carbon dioxide zero balance is realized. That's why particular interest is the willow as a plant is able to grow under conditions of high humidity, on different types of soil including types of soils which are characterized by low levels of fertility and opposite high content of organic and mineral contaminants. Willow can be used for creation zones of purification on places of former dumpsites and industrial areas. In addition, the willow provides a minimal cost for energy in comparison with other energy crops.

The aim of study is energy evaluation of operation of boiler JSC "Peat Briquette Plant "Lidskij" with research of fuel which is a mixture of peat and wood chips of fast-growing willow with chip share from 5 to 50%.

To achieve this aim following main tasks have been solved:

- natural moisture, ash content of fractions of woody biomass and specific calorific value of dry fractions of woody biomass are defined;
- calibration thermal and aerodynamic calculation of boiler unit KE-10-14C of boiler room of "Peat Briquette Plant "Lidskij" during operation on base fuel (milled peat) and during co-firing peat with fast-growing willow for different percentages of peat-willow was done with analysis of results;
- calculation of emissions of pollutants into the atmosphere for basic and project variants was done with analysis of results.

Study results showed that increasing content of willow chips in fuel leads to increase of boiler efficiency from 83,03% for 5% chips in mixture to 84.95% for 50% chips in mixture. Fuel consumption is reduced from 0.880 kg/s for 5% chips in fuel to 0.830 kg/s for 50% of wood chips because fuel combustion heat increases.

Khotko A., Razumenko A., Kundas S.

Belarusian National Technical University, Minsk, Republic of Belarus

BARIERS OF RENEWABLE ENERGY DEPLOYMENT

Governmental policies play a crucial role in accelerating the deployment of renewable energy (RE) technologies. Energy access and social and economic development have been the primary drivers in most developing countries whereas secure energy supply and environmental concerns have been most important. RE policies have promoted an increase in RE capacity installations by helping to overcome various barriers. Barriers specific to RE policymaking, to implementation and to financing may further impede deployment of RE. A wide application of RE would require policies to address these barriers, and to help to overcome challenges such as the lack of infrastructure necessary for integrating RE into the existing system.

It is possible to classify the mentioned barriers as follows:

- Techno-economic barriers;
- Non-economic barriers (regulatory and policy uncertainty barriers, institutional and administrative barriers);
- Market barriers;
- Financial barriers;
- Infrastructure barriers;
- Lack of awareness and skilled personnel;
- Public acceptance and environmental barriers.

Techno-economic barriers relate to the direct costs of a certain technology in comparison to competing technologies.

Non-economic barriers relate to factors that either prevent deployment altogether (no matter how high the willingness to pay) or lead to higher costs than necessary. These barriers can be differentiated further:

Regulatory and policy uncertainty barriers, which relate to bad policy design, or discontinuity and/or insufficient transparency of policies and legislation.

Institutional and administrative barriers, which include the lack of strong, dedicated institutions, lack of clear responsibilities, and complicated, slow or non-transparent permitting procedures.

Market barriers, such as inconsistent pricing structures that disadvantage renewables, asymmetrical information, market power, subsidies for fossil fuels, and the failure of costing methods to include social and environmental costs.

Financial barriers associated with an absence of adequate funding opportunities and financing products for renewable energy.

Infrastructure barriers that mainly center on the flexibility of the energy system, e.g. the power grid, to integrate/absorb renewable energy.

Lack of awareness and skilled personnel relating to insufficient knowledge about the availability and performance of renewables as well as insufficient numbers of skilled workers.

Public acceptance barriers linked to experience with planning regulations and public acceptance of renewable energy.

*Environmental barriers are connected with influence of RE on ecology (w*ind energy – visual, noise, problems for birds and marine mammals (offshore wind parks, hydro energy – land flood, problems for fish migration at al.).

Because the deployment of modern renewable energy is relatively recent in many countries, past initiatives for the development of RE have largely focused on the reduction of economic barriers. Trends of all these barriers overcoming in European Union countries and situation in the Republic of Belarus are discussed in this presentation.

Konkova V., Narkevich I.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

GREENHOUSE GAS EMISSIONS FROM THE PEATLANDS

The main factor of global changes in the XX century and nowadays is the global warming that proceeds over 100 years. The most common hypothesis about the cause of global warming is the buildup in the atmosphere of gases such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), etc., molecules that entrap a long-wavelength part of radiation from the earth's surface and create a greenhouse effect, that is contributing greatly to self-heating of the atmosphere.

Since the middle of the 18th century, atmospheric concentrations of these gas traces have increased strongly. Until the present, atmospheric carbon dioxide (CO_2) concentration has increased from 280 to 388 ppm, atmospheric methane (CH_4) concentration from 715 to 1800 ppb and nitrous oxide (N_2O) from 270 to 323 ppb. This fast rise in atmospheric concentration caused absorption of heat radiated from the Earth surface and in all likelihood contributed significantly to the 0.6°C increase of mean global temperatures. The increase in atmospheric concentration of GHGs is the main cause of anthropogenic climate change. The contribution of CO_2 to the anthropogenic greenhouse effect is 63%, that of CH_4 18%, and that of N_2O 6%. The climate effect of the latter two gas species is mainly because of their much higher global warming potential compared to CO_2.

The world community wakes up to the important role of peatlands in the control concentration of greenhouse gases in the atmosphere. Covering only 3% of the

land surface, they store in their peat twice as much carbon as the entire global forest biomass and responsible for overproportionate 6% of global anthropogenic greenhouse gases emissions.

Belarus is one of the more important peatland countries in the world. With a total peatland area of 22,352 km^2 Belarus ranks 15th among all countries of the world, with respect to peatland proportion (% of the country) it ranks 20th and with respect to actual carbon stock 21st. Much higher is the score of Belarus with respect to peatland emissions; with 41 Mt CO_2 $year^{-1}$ Belarus is the 8th most important country in the world. In terms of total emissions per unit land area, Belarus occupies the third place third after Indonesia and Estonia with 1.99 t ha^{-1}.

In the anoxic part of the peat soil CH_4 is formed by a group of microorganisms called methanogens, which phylogenetically belong to *Archaea*. If the peat becomes oxygen-rich in deep as a result of drainage, methane oxidation dominance makes peatlands in trace run-off atmospheric methane.

Conventionally, the production of N_2O is linked to the microbial soil processes of nitrification and denitrification. Formation of N_2O is due to the fact that becomes available inorganic nitrogen such as ammonium or nitrate through mineralization peat, fertilizer application or through nitrogen sequestration. With a nitrogen debt undisturbed peat will be N_2O run-off because microorganisms are able to use N_2O as a substrate for the formation of N_2 during denitrification.

Greenhouse gases streams are measuring by the method of chambers.

In general, there are three main modifications chamber method:

• method of open dynamic cameras;

• method of static closed chambers;

• method of dynamic closed chambers.

The chamber is set on up the study area with open lower base. Greenhouse gases streams from soil are measured by the rate of variation concentration of these gases within the chamber.

Zhuk E., Melnik M.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

PARAZITOFAUNA OF HELMINTHS OF UNGULATE INHABITANTS OF GKPU "MINSK ZOO"

Hoofed animals in zoos live in the conditions that strongly differ from natural. One of the serious reasons that negatively influence on the number of hoofed animals in zoos is the group of the diseases caused by parasites. Parazitoza reduces reproductive ability at small valuable animals that causes essential economic losses. Sick animals become a source of infection for healthy animals. Identification of parasites and monitoring them in the conditions of zoos has relevance for implementation of rational methods for prophylaxis and total healing.

On the basis of "Minsk Zoo" researches on a condition of a prevalence of hoofed inhabitants helminthic invasions. At inspection of 71 individuals of representatives of groups one-hoofed and artiodactyl 5 genuses of helminths are registered: Trichocephalus, Strongylata, Fasciola, Nematodirus, Capillaria.

Helminths of the genus Strongilata have the most wide range of owners and are noted at 13 types of representatives of noted inhabitants of "Minsk Zoo". It is established that the helminth of the genus Strongilata is the most widespread. The maximal contamination is revealed by helminths of this genus at a vintorogy goat. Average degree of an invasion on one individual makes 92,3 parasites.

The genus Trichocephalus is found in 3 types of representatives of ungulate inhabitants of a zoo - a boar, an elk and a bactrian camel. The maximal contamination is revealed at a bactrian camel. Average degree of an invasion on one individual makes 33,6 parasites.

Helminths of the genus Fasciola and Namatodirus are registered only at two types: David's deer and bactrian camel respectively. The average invasion at David's deer on one individual makes 0,33, and at a bactrian camel is up to 2,33.

The least variety of helminths is noted among the Osheynikovy baker who has helminths only of one genus - Capillaria. Average degree of an invasion on one individual is up to 1,67 parasites.

The richest gelmintofauna is revealed at bactrian camel, only 4 of 5 genuses of the helminths revealed as a result of a research. At this representative of hoofed animals the following genuses of helminths are revealed: Trichocephalus, Strongylata, Nematodirus, Capillaria. Trichocephalus which average degree of an invasion on one individual up to 33,6 parasites was the dominating genus of helminths.

Studying of a parazitofauna of helminths of hoofed animals in a zoo gives the chance of preventive actions against distribution of helminthic invasions among inhabitants of a zoo and to monitor the health of inhabitants in a zoo.

Moroz A., Chemerevskiy D., Antonova V., Tonkonogov B.

International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

INTEGRATED INFORMATION SYSTEM FOR ANALYSIS OF POTENTIAL OF RENEWABLE ENERGY SOURCES

In the Republic of Belarus (RB) the efficient use of renewable (alternative or non-conventional) energy sources (RES) is largely dependent on the correct assessment of the resource potential of the region, the availability of appropriate technology and equipment, the required infrastructure and the regulatory framework. Considering the spatial and temporal distribution of renewable resources and its' relationship in many cases from natural and weather conditions, an effective solution to this multicriteria problem is possible only with the use of information technology and automation.

In the Belarusian National Technical University in cooperation with the International Sakharov Environmental Institute of Belarussian State University developments in the field of informatization and analysis of renewable energy resources were started. Having a considerable experience of the development of databases and decision support systems in the field of RES at the regional level, it is planned to create a Web-based integrated information system for analysis of the potential of RES with the possibility of its use at the level of the whole territory of the RB. The main functional components of the system:

- informational part (technical and operational parameters of the equipment and resource data in the field of RES with the use of database technology and the possibility of integration with the State cadaster of RES);
- analytical part (integrated calculation of the energy potential and cost-effectiveness of the use of RES with application of geographic information systems technology and the possibility to customize the estimated coefficients and the attribute information according to the geographical location of objects (equipment, resources and administrative and economic units) and regional legislation);
- remote services (decision of multicriteria logistical tasks with the use of the geographical location technology and the possibility to optimize the use of time, material and labor resources).

Thus, the development of the mentioned system is an actual scientific and practical task, decision of which will create conditions of popularization, extension and increasing of the efficiency of use of RES and, as a consequence – reducing the use of hydrocarbon energy sources, decreasing the energy dependence level and improving the environmental indicators, energy savings and energy security of the RB.

Nekrashevich A.[1], Tonkonogov B.[2]

[1]Belarusian State University of Informatics and Radioelectronics, Minsk, Republic of Belarus;

[2]International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

ENVIRONMENTALLY FRIENDLY ELECTRIC DRIVE FOR BICYCLES AND CARTS

Nowadays electric bicycles (EB) are gaining the increasing popularity. With their help anyone, even not trained person, can quickly and efficiently overcome long distances and save time, material and physical resources. However, EB like electric transport in general have one common problem its price. A lot of people want to have EB itself, but simply cannot afford it.

There are kits for conversion of the simple bicycle into the electric one, but these kits are also not cheap and require quite difficult refit of bicycle. The main parts of such sets are: 1) electric motor; 2) accumulator battery pack; 3) electronic controller for the motor.

For EB a motor with a rather large torque, capable to reach average speed for cyclist is needed, and to achieve this there are some known solutions of using:

- motor wheel – rather large motor with high torque, that does not require any reduction gears and is mounted instead of the standard bicycle wheel hub;
- outboard – revving motor, which is mounted to the bicycle frame and, as a rule, has a smaller torque, but use an additional gear to reduce turns and increase torque.

Both solutions have common disadvantages: dimensions, weight, cost and difficulty of installation. That is why, the aim was in creating kit and technique for conversion of the common bicycle into the electric one considering ease of installation, light weight and affordable price.

To create a lightweight EB a light motor is needed to use, but any light motor demands a reducer to achieve the necessary parameters and that will finally lead again to a large weight. The solution of this problem turned very simple – instead of making additional gears, it can be used the wheel and the frictional transmission, thereby not increasing the weight of the assembly. Using a small diameter roller and, resting it in the tire of a bicycle wheel, it can be achieved a small weight and simplicity of the whole construction.

Over time, the motor was selected, which has a function of a roller, that simplified and facilitated the entire construction even more. Then it was designed a mount that automatically disconnects the motor from the wheel in order not to prevent the free movement of the bicycle. But as soon as the motor is switched on, it pushes itself into the tire and the more power it is fed on it, the more it will press in itself, thereby eliminating the main problem of the friction transmission – slipping. Also currently to avoid it the best coverage for the motor is searching, that the system can work in the rain or puddles and with minimum wear out of the bicycle wheel tire. The other parts, such as controller and battery pack are the same as in conventional EB.

Thus, all solutions have their pros and cons. Main disadvantages of the designed system – accelerated tire wear out and the possibility of the motor slipping at high powers. But the biggest advantage of this design – its weight and price, that are in times less than in other solutions. The mentioned kit can be used in the cities or villages both for bicycles and farming carts thus increasing the speed and effectiveness of different activities. And the more people will use EB the less conventional vehicles polluting environment will be used and that will finally lead to environmental situation improvement.

Tkachenko S., Nizhnikov A., Malishevsky V.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

TO THE QUESTION OF THE USE OF SOLAR ENERGY IN THE LABORATORY PRACTICE IN PHYSICS

One of the most promising methods of generating clean electricity is recognized as a way to photovoltaic conversion of solar radiation. The Republic of Belarus on the amount of light energy incident on the unit area is roughly on par with Germany, Japan, Canada, the countries where one of the priority areas of energy production in the 21st century is photovoltaics (PV-Industry).

Therefore, the inclusion in the laboratory practical works on physics by the method of photovoltaic power generation is of particular importance. We have developed laboratory work to study physical and technical characteristics, the time dependences of the number of converted solar energy into electrical energy and other parameters of a photovoltaic installation on the basis of available ISEI nine solar panels with total capacity of 1080 watts.

Performing students of laboratory work demonstrates not only the work of solar power, but also require many calculations at the same time. In addition, solar panels will be used to illuminate teaching laboratories. Given the low solar activity at the latitude of the city used a hybrid scheme. In the absence of the necessary solar activity and the full charge batteries this circuit connects the power end users to the static electric power line.

For the calculation and assignment of power settings used microcomputer «Raspberry Pi» with a power consumption of 1 watt, which manages the electricity distribution process and allows you to take the system performance and ongoing monitoring. This will assess the state of work, power consumption, temperature indicator, the degree of charging and discharging.

Use for lighting educational laboratories LEDs enables to assess their energy efficiency relative to other light sources and analyze the comparative characteristics such as durability, resource strength, shock and vibration resistance, operating voltage, environmental and fire safety.

Velichko V., Kulikovskaya M., Kundas S.
Belarusian National Technical University, Minsk, Republic of Belarus

PRETREATMENT OF BIOMASS AS METHOD OF INCREASING BIOGAS OUTPUT

One of the ways to increase the efficiency of biogas technology is the biogas yield improvement. It is known that agricultural substrates (for example maze silage and wheat straw) are widely used for biogas production as main or additive sub-

strate. In this type of substrates the main source of the biogas formation are starch, cellulose and hemicellulose decomposition products. While starch degraded quite easily under standard fermentation conditions, cellulose and hemicellulose are practically not decomposed under normal conditions, thereby substantially reducing the economic feasibility of using such types of biomaterials. Therefore, the aim of the present study was to analyze the methods of pre-treatment of various types of biomass to achieve the destruction of its cellular integrity. It was found that the main reasons that do not allow microorganisms to break down the biomass structure are:

1) the crystal structure of the substrate;

2) low contact surface area between the substrate and the microorganisms;

3) the content of chemicals in the substrate which have an inhibitory effect on the microorganisms;

4) substrates during fermentation constitute a floating layer or foam;

5) substrates do not meet sanitary and epidemic rules and can't be used in their raw form.

Analyzed pre-treatment methods:

- Mechanical pretreatment. This kind of pretreatment is carried out with mills and shredders to squeeze or cut substrate into smaller parts for increasing contact surface area. Such procedure increases biogas yield to 15–25%, depending on the substrate and different method details.
- Chemical pretreatment uses a range of different acids and bases under different conditions to break down some bonds between lignin and hemicellulose, to solubilize lignin fraction and so on. Typical chemical pretreatment are alkali pretreatment, acid pretreatment and oxidative pretreatment. It can increase biogas yield up to 20%.
- Biological pretreatment. It can be two-stage digestion pretreatment - hydrolysis and acid production are separated from methane production (additional biogas yield up to 21%), fungal pretreatment – adding fungi into digester to accelerate digestion and enzyme pretreatment – adding into digester enzymes, that break down biomass (additional biogas yield near 10%).
- Thermal pretreatment is heating substrates to the temperature in the range of 125 to 190 ^{0}C under the pressure of 20 to 30 bar and holding at that temperature for up to one hour. Some studies showed that thermal pretreatment increases biogas yield to 20 or even 30%.
- Combined pretreatment – this processes are combination of different pretreatment types (steam explosion, extrusion). This is the most effective kind of pretreatment, some laboratory tests showed biogas yield increasing up to 70% and even more.

Also there are some pretreatment technologies that are effective for non-lignocellulosic substrates. For example sometimes animal by-products require hygienisation or sterilization before they will be used for biogas production. Ultra-

sound treatment can be used as a pretreatment for sewage sludge, but it doesn't disintegrate lignocellulosic material.

The analysis shows that each of the methods of pretreatment has its advantages and disadvantages, therefore optimal and universal method for the all kinds of substrates does not exist, but the pretreatment can significantly increase the biogas yield and should be developed and improved in the future.

Lebiadzinskaya Kr.
International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus

THE DIRECTIONS OF IMPROVING OF INTEGRATION POLICY IN ENVIRONMENTAL MANAGEMENT IN THE REPUBLIC OF BELARUS

Different countries have different approaches in solving environmental problems. In Belarus, the assessment of sustainable development, environmental safety and rational use of natural resources is mainly viewed in five directions: forest resources and their use, conservation of biological diversity of species, including protected areas and biological reserves, energy efficiency, control of industrial emissions, greenhouse effect and the destruction of the ozone layer.

One of the pressing environmental problems in Belarus is rational use of forest resources. As you know, the forest in Belarus carries out a number of vital functions. It not only serves as raw material for the wood processing industries, but plays an important role in the formation of the atmosphere and climate, ensures the preservation of watersheds, soils, and biodiversity of species. In a broad sense, forest is a holistic set of trees and plants, soil, animals, microorganisms and other natural ingredients that compose the internal relations between each other and communicate with the external environment.

In the process of photosynthesis, forests absorb carbon from the atmosphere and convert it into biomass. Conserving this "fuel", forests replace the consumption of carbon with the oxygen and give it back to the atmosphere. Besides photosynthesis, forest ecosystems emit carbon by decomposing organic matter. The source of the decomposition is the vital activity of animals, fungi, bacteria and plants. In the primary forests the production of oxygen and carbon emissions is very balanced. These forests are holders of the conserved carbon in the form of plant biomass, deadwood, litter and soil humus, and this storage by itself can not cause the "greenhouse effect."

Forests are subject to various influences of violation as deforestation and continuous violent use of forests, fires, outbreaks of pests, soil contamination and windfalls. These effects lead to an imbalance, loss of carbon stocks and emissions of carbon dioxide into the atmosphere.

The solution for such problems as afforestation, disorders, burns and felling might be in reforestation and placement of young mixed forests. Such actions will eventually lead to the alignment of the carbon-oxygen exchange through the accumulation of biomass and carbon stock replenishment storage with the release of oxygen into the atmosphere. But if the damaged target areas will be changed into the land of use for the agriculture purposes we will not be able to receive the compensation of losses. It is highly important to preserve the original purpose of the forests and implement reforestation programs on the damaged areas. It is also necessary to find the balance between the increments of forest grounds and agricultural lands.

According to the data of the National Statistical Committee of the Republic of Belarus on the issue of afforestation and reforestation, the cutting of the main use forests has not increased for the last 7 years, but unfortunately we can note, that the area of "new forest" decreased. We also see a very low increase in forest planting in Brest and Grodno regions, which have the same indicators observed for over 5–7 years and can be noted as the territory with the lowest increment of the afforestation. Activities to restore the afforestation in these areas would allow us to increase the level of absorption of carbon dioxide from the atmosphere and extent compensation of the increasing allocation of CO_2 from other sources. These measures would contribute to the fulfillment of certain obligations of the Republic of Belarus to the international community in the framework of the Paris agreement.

In current conditions the main task for the environmental activities in Belarus should be in the sustainable management of forest resources, in careful and conscious attitude to forest wealth excluding its unsustainable exploitation and degradation. By fulfilling the obligations of Paris agreement, Belarus should reach the optimum rate of deforestation, perform forest preservation at an acceptable level (neither too high and unsustainable and neither too low – especially where we see the unbalanced age group mix of trees); integrated environmental approaches into forestry policy, including Eco-certification and carbon sequestration. With this approach to environmental management in the forestry sector eventually we can reach a considerable reduction of the environmental threats that entail climate change and the "greenhouse effect".

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Научное издание

АКТУАЛЬНЫЕ ЭКОЛОГИЧЕСКИЕ ПРОБЛЕМЫ

МАТЕРИАЛЫ VI МЕЖДУНАРОДНОЙ НАУЧНОЙ КОНФЕРЕНЦИИ
МОЛОДЫХ УЧЕНЫХ, АСПИРАНТОВ, МАГИСТРАНТОВ, СТУДЕНТОВ
24–25 ноября 2016 г.
г. Минск, Республика Беларусь

На английском языке

Публикуется в авторской редакции

Компьютерная верстка *Д. В. Головач*

Подписано в печать 14.11.2016. Формат 60×90 $^{1}/_{16}$.
Бумага офсетная. Гарнитура Times. Печать цифровая.
Усл. печ. л. 13,9. Уч.-изд. л. 13,75.
Тираж 160 экз. Заказ №

ИООО «Право и экономика» Лицензия ЛИ № 02330/0494335 от 16.03.2009
220072 г. Минск, ул. Сурганова, 1, корп. 2. Тел. 284 18 66, 8 029 684 18 66
E-mail: pravo-v@tut.by
Отпечатано на издательской системе KONICA MINOLTA
в ИООО «Право и экономика»