

МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ
УЧРЕЖДЕНИЕ ОБРАЗОВАНИЯ
«ГОМЕЛЬСКИЙ ГОСУДАРСТВЕННЫЙ МЕДИЦИНСКИЙ УНИВЕРСИТЕТ»

Department of the General Hygiene, Ecology and Radiation Medicine

ECOLOGY

**Учебно-методическое пособие
для студентов 2 курса
факультета по подготовке специалистов
для зарубежных стран**

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Настоящее учебно-методическое пособие предназначено для студентов медицинских вузов, обучающихся на английском языке. Учебное пособие состоит из трех разделов и посвящено изучению общей экологии с вопросами медицинской экологии, рассчитано на 12 часов практических занятий.

Учебно-методическое пособие соответствует требованиям высшей школы.

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**TOPIC 1: BASIS OF THE GENERAL ECOLOGY.
BALANCE OF ENERGY AND SUBSTANCE IN BIOSPHERE.
BIOGEOCHEMICAL CYCLES**

Total time: 4 hours

URGENCY OF A THEME

Research of environmental factors and adaptation to them of organisms was the main subject of ecology for some time. As the central object in it the separate organisms as representatives of a concrete kind were considered.

The modern ecology is developed in three basic directions:

- First, a problem of survival of mankind in conditions of becoming aggravated contradictions with the environment.
- Second, necessity of preservation of biosphere stability of the Earth testing anthropogenous pressure and, at last.
- Thirdly, a problem of preservation of human health who is in conditions of promptly changing environment of his dwelling.

THE PURPOSE

To show a role and a place of ecology in modern system of knowledge.

TASKS

1. To know the basic concepts of the general ecology. To show value of medical ecology, its purposes and tasks.
2. To be able to reveal connection of population disease with a environmental conditions and to give the ecological estimation of a situation.

VOLUME OF INDEPENDENT WORK OF STUDENTS

To learn interconnection a level of population diseases with the environmental conditions; to be able to detect «environmental» diseases.

TO PREPARE REPORT AT THEMES

- Development of the general ecology and human ecology.
- The basic concepts and principles of the general ecology and human ecology.
- Ecological and medical problems of environmental contamination.
- Urbanization and health of the population.
- Influence of weather conditions and solar beams on various systems of human organism.
- Influence of environmental factors on adaptive response of human organism.

THE BASIC QUESTIONS FOR CLASS

1. Concept about ecology as scientific discipline. A subject of ecology and stages of its development.
2. Medical ecology: concepts, the purposes, tasks. «Environmental» diseases. Changes of health state of the population at present time.

3. Concept about biosphere, noogenesis, noosphere. Components of biosphere.
4. Ecosystem. Components of ecosystems and their characteristic. Features of energy and substance stream in ecosystem.
5. The basic types of ecosystems. Characteristics of city as ecosystem. Agricultural ecosystem.
6. Ecological factors and their characteristic. Concept about the ecological niche, the «limiting» factor.
7. «Circulation» of energy in biosphere.
8. Concept about producers, consumers, decomposers.
9. Trophic levels, trophic chains and trophic web.
10. Biogeochemical cycles and their features (reserve and mobile funds BGHTS).

AUXILIARY MATERIALS

Ecology (from Greek oikos — the house, dwelling and logos — the doctrine) — the biological science studying laws of vital activity of organisms at all levels of the organization (populations of organisms, kinds, biocenosis, ecosystem) in their nature dwelling in view of the changes made by man activity. To modern understanding more corresponds such definition as sciences about structure and functions of animate nature. The term is offered in 1869 by German zoologist E. Gekkel.

In the middle of 80 th years the separate direction — medical ecology was generated (or the ecological medicine) is the complex scientific discipline studying influence of environmental factors on human health with accent of attention on so-called «environmental diseases». As criterion of the optimality of environmental conditions accept complex criterion — human health. By definition the WHO, this concept includes not only absence of illnesses and corporal defects, but also a state of physical, mental and social well-being of the man.

Tasks ME:

1. Formation at physicians of ecological thinking and understanding of mechanisms of influence of the man on environment and, on the contrary, influences of environment on the man.
2. Indication of environmental contaminations and preservation of the inhabitancy.
3. Finding-out of interrelation between environmental condition of and human health and a human population as a whole.

Much more often, than illness, develops so-called «the third condition», so-called anthropoecological tension which is shown in bad state of health, infringement of a normal rhythm of sleep and wakefulness, decrease of workability, etc. nonspecific signs. The factors causing anthropoecological tension, can have the most various character, for example: change of climate or imbalance of the nutrition; life in narrowness or, on the contrary, in loneliness; entrance to organism of harmful chemical substances, etc.

Biosphere

Basis of ecology is the doctrine about biosphere (BS). The biosphere is the largest and the closest to the ideal in sense of «self-sufficiency» biosystem. The biosphere is the external environment of the Earth, area of distribution of life which includes all alive organisms and all elements of animate nature forming the inhabitancy of alive organisms. The biosphere includes the lower part of atmosphere, all hydrosphere (hydrobiosphere) — oceans, seas, superficial waters of land, terra biosphere — a surface of the land, and also lithosphere — the upper horizons of a hard the earth's crust. Borders of biosphere are determined by physical and chemical conditions of life existence. The lower border of biosphere — in deep into land 1–2 kms and is lower 2–3 kms than bottom of the ocean; top — the ozone cloud at height 20–25 km.

Due to reasonable activity of people BS should pass into new harmonious condition — the noosphere (covering of reason) (Le Rue, Teyar de Sharden).

Vernadskij V. I., the founder of the doctrine about BS, marked the following basic preconditions of creation of noosphere:

1) The mankind should become a single whole; 2) transformation of a communication and exchange facilities; 3) opening of new energy sources; 4) rise of well-being of people; 5) exception of wars from society life. Thus, «noosphere» is one of stages of development of biosphere when reasonable man activity is the dominate factor of development when there is a reasonable regulation of man-nature relations. Development of biosphere with formation of noosphere name noogenesis.

Ecosystem

In ecology the basic functional unit is ecosystem (ES). Term «ES» has been offered in 1935 by the English ecologist A.G. Tansley though representation about «ES» has arisen much earlier. «ES» — complex of in common living various kinds of alive organisms and the conditions of their existence joint into functional whole. Ground ES frequently name biogeocenosis.

From definition ES it is visible, that it will consist from:

- 1) biocenosis, i.e. sets of the interconnected alive organisms;
- 2) ecotope, i.e. this place of biocenosis dwelling. Ecotope is a set climatic-soil-ground factors;
- 3) interaction of biotic association with the physical environment.

All ES are open systems as should receive and give energy.

Artificial ecosystems we shall consider by the example of city and agricultural ecosystem.

Agricultural ecosystem (AES) have the following features:

- 1) they receive taking place under the human control the auxiliary energy supplementing or replacing solar;
- 2) as a result of man activity a variety of organisms is sharply reduced to receive the maximal interest of any one product (food or other), i.e. it is a mono-

culture more often. The organic substance is made in superfluous quantity for the given system;

3) dominating kinds of plants and animals are exposed artificial, instead of to natural selection;

4) the AES is worse, than natural, keep in circulation the microelements; i.e. now for maintenance of productivity it is necessary to add to fertilizers track quantities of microelements.

In other words, the AES are organized and cope so that to direct as much as possible to solar and other energy on manufacture of agricultural products (in particular food stuffs).

Such intensive and specialized land tenure, as a rule, is accompanied by a soil erosion, pollution of water reservoirs because of washout of pesticides and the fertilizers, the increased sensitivity of system to pest.

City ES are incomplete, or heterotrophic. The city differs from natural heterotrophic systems:

1) More intensive metabolism on unit of the area.

2) The big requirements for receipt of substances from the outside.

3) More powerful and more poisonous stream of waste products.

The ecological factor is any element of the environment, capable to render direct or indirect action on alive organism even on one of stages of its individual development, or any condition of environment which the organism answers adaptive reactions.

Classification of Ecological Factors

Abiotic factors	Biotic factors
<p>Climatic: solar radiation, light and light mode, temperature, humidity, atmospheric precipitation, pressure, etc.</p> <p>Edaphic: mechanical and chemistry structure of soil, a moisture capacity, a water, air and thermal mode of ground, structure of ground, a level of subsoil waters, etc.</p> <p>Orographical: a relief, an exposition, height above sea level</p> <p>Hydrographic: factors of the water environment</p> <p>Chemical: gas structure of an atmosphere, salt structure of water</p>	<p>Phytogenous (influence of plants)</p> <p>Zoogenous (influence of animals)</p> <p>Anthropogenous — straight lines and indirect influences on environment, connected to human activity</p>

Interactions between alive organisms can be homotypic and heterotipical. The most widespread type heterotypical interactions between animals — predatoriness (preying on others). From other forms are known parasitism, commensalism (one organisms eat the rests of food or egesta others, for example, hyenas and signature stamps), синойкую (cohabitation), neutralism, a competition, pol-

mination of plants by animal (insects), форе́зию, i.e. carry by one kinds of others (for example, seeds of plants birds).

Ecological niche — set of all environmental factors in which existence of a kind in the nature is possible.

One of founders of agrochemistry — German scientist Justus Libih (1803–1873) has formulated the law of the limiting factor: «**Vital opportunities limit ecological factors, the quantity and quality which are close to a necessary organism or ecosystem to a minimum.** The further decrease of the necessary factor conducts to destruction of the organism or ecosystem».

The limiting factor is any factor which limits development or existence of the organism, a kind or community. American zoologist V. Shelford (1877–1968) has come to a conclusion, that the limiting factor can be not only lack, but also surplus of such factors, as light, warmly, water. (Shelford's law of tolerance).

In sanitary protection of E the top limits as environmental contamination is are important and there is excess of stability of the organism (definition of maximum concentration limit).

Initial production on the Earth is created in cells of green plants under influence of a solar energy (photosynthesis), and also some other organisms (bacteria owing to chemical processes — chemosynthesis). The essence of photosynthesis will be, that there is increase in free energy in organic substance due to transformation of energy of sunlight photon.

Special group chemosynthetits form nitrifying bacteria. They receive necessary energy due to oxidation of ammonia, hydrogen, connections of iron without participation of Sun energy.

The first trophic level occupy автотрофы (producers), the second — herbivorous animals (consuments of the first order), the third predators (consuments of the second order), and parasites of initial consuments. And, at last, secondary predators and parasites form the fourth level. The number of parts in a circuit can be various, but usually them it happens from 3 up to 5.

Producers — synthesize with the help of a sunlight from CO_2 and H_2O , and also mineral substances organic connections.

Consumers — animal organisms which eat ready organic substance of plants and animals.

Decomposer — oxidize dead organic remains into CO_2 and H_2O (bacteria, mushrooms, protozoa).

Carry of energy from its source through a number of organisms name a trophic circuit. At each carry the most part (80–90%) potential energy is lost, passing in heat. Trophic level — complex of the alive organisms receiving solar or transformed chemical energy through identical number of intermediaries into trophic circuit.

Biogeochemical Cycles

BGCC — characteristic ways on which chemical elements circulate in biosphere from the environment in organisms and again into environment.

In each circulation allocate 2 funds:

— Reserve fund — a part of circulation of elements which physically or is chemically separated from organisms.

— Mobile or exchange collection — actively circulating fund, for it is characteristic a fast exchange between organisms and their direct environment.

On reserve fund BGHTS it is possible to subdivide on:

1) BGCC with reserve fund in atmosphere (N, O);

2) BGCC with reserve fund in hydrosphere (C);

They quickly compensate arising infringements.

3) BGCC with sedimentary reserve fund, i.e. reserve fund is in the earth's crust (S, P) - they are less subject to self-checking, are worse restored.

PRACTICAL WORK

The task 1. To establish correlation between the increased contents of harmful substances in atmospheric air and diseases of respiratory organs according to social-and-hygienic monitoring and reports on disease.

The task 2. To assess the received results.

The task 3. To offer actions on health improvement of the population.

The task 4. To issue results of work in a diary.

TASK

To establish correlation between air pollution by the increased concentration NO in Gomel and morbidity of respiratory organs in 1997–2001 years

Years	Diseases of respiratory organs	Concentration NO	dx	dy	dx ²	dy ²	dx, dy
1997	29.7	0.0054					
1998	30.8	0.0087					
1999	34.1	0.0156					
2000	32.9	0.0126					
2001	35.3	0.0179					

dx, dy — deviations from average level.

Correlation factor

$$r_{xy} = \frac{\sum dx * dy}{\sqrt{\sum dx^2 * \sum dy^2}}$$

TOPIC 2: BIOLOGICAL RESOURCES. ECOLOGICAL AND MEDICAL CONSEQUENCES OF THE ATMOSPHERE AND HYDROSPHERE POLLUTION

Total time: 4 hours

URGENCY

Present stage of social development is characterized by strengthening of industrial influence of the man on biosphere. Rapid development of industrial forces, growth of a planet population results in the exhaustion of irreplaceable natural resources, infringement and environmental contamination.

Well-being of people becomes more dependent on quality of the natural environment. Therefore necessity of conservancy and careful use of resources began one of actual problems of the present.

Now is not ecological systems on a planet where would be no adverse changes as a result of human activity. Each kind of living organisms lives in that ecosystem to which conditions was adapted during evolution. Changes of these conditions can suppress vital activity of organisms and even to cause their death.

To anthropogenous influence in ecosystem are exposed: the atmosphere, lithosphere, hydrosphere, and victims of these fatal changes are living organisms.

Everywhere environmental contamination results in destruction of biological resources which are the carrier of a genetic material. Such phenomena widely distributed recently as: acid precipitation, destruction of the ozone layer, a hotbed effect, etc. render adverse influence not only on the nature, but also on human health.

The special alarm of medical ecology is caused with the illnesses connected to trouble of biosphere: diseases of the upper airways and allergic, the illnesses connected to receipt of xenobiotics to the organism.

THE PURPOSE

To study ecological consequences of atmosphere and hydrosphere pollution. To give the characteristic to ecologically dangerous anthropogenous pollutants, to examine their transformations under influence of various factors; to show influence anthropogenous pollutants on ecosystems. To show presence of ecologically dependent diseases of the population.

Problems: To learn simple methods of the analysis of polluting substances in air and in water. To realize the importance of environment preservation favorable for life.

VOLUME OF INDEPENDENT WORK FOR STUDENTS

To give the characteristic ecologically dangerous anthropogenous pollutants, to study their transformations under influence of various factors. To make the table «Harmful substances and their influence on the organism», showing interrelation between pollutants, present in the environment, and illnesses. To show connection between character and degree of environmental contamination and morbidity of the population.

To prepare reports on themes:

- Ecological and medical problems of environmental contamination.
- Infringement of the ozone layer and human health.
- Pollution of the atmosphere by oxides of sulfur and population health.
- Influence of exhaust of automobiles on health of people.
- Influence of photochemical oxidizers on state of human health.
- Acid precipitations and population health.
- Deposition and accumulation of harmful substances in various objects of the environment.
- The disturbance of health connected to application of new chemical substances.
- Sources of entering of nitrocompounds to the human organism.
- Ecological and medical problems of environmental contamination by dioxine.
- Ecological and medical problems of environmental contamination by heavy metals.
- Bioindication as means of the analysis of environment quality.

REQUIREMENTS TO THE INITIAL LEVEL OF STUDENT KNOWLEDGE

For full mastering a theme it is necessary for students to repeat from:

- 1) Microbiology — themes «Ecological environments of microorganisms. Air microflora. Microflora of water reservoirs, sources of contamination by microbes of environmental objects».
- 2) The general chemistry — «Toxic action on organism of lead, mercury, copper compositions, «Biogenic elements as factors of the environment».
- 3) Medical biology and genetics — «Harmful influence of smoking on the human organism», «Organism as inhabitancy. Interaction of the parasite and the owner at individual level and at population level».

CONTROL QUESTIONS FROM RELATED SUBJECTS

1. What role do play air microflora in distribution of infectious diseases?
2. What mechanisms of damaging action of the UV-irradiation do you know?
3. What molecular mechanisms of protection from the UV-irradiation do you know?
4. Role of biogenic elements as factors of the environment.
5. To list physical properties of air.
6. To name a chemical compound of air.
7. What are there processes of coagulation at sewage treatment and drinking water?

THE BASIC QUESTIONS TO LESSON

1. Biological resources, their use.
2. Protected natural territories. Recreational resources.
3. Concept about the atmosphere, its structure and composition.
4. Sources of pollution — natural and anthropogenous.

5. The basic pollutants of atmospheric air, their action on the human organism and an environment (sulfur dioxide, nitrogen oxide, carbon oxide and dioxide, radionuclids, flying and organic compositions, compositions of heavy metals).

6. Chemical transformations of air pollutants and their consequences:

a) Acid precipitation — their sources, action on the human organism and environment;

b) Photochemical smog; ozone and other photochemical oxidizers, action of tropospheric ozone on the human organism and environment;

c) Ozone hole — the mechanism of destruction of the ozone layer, biological consequences of short-wave ultra-violet radiation.

7. Concept about hydrosphere. The general representations about useful fresh water resources on the Earth.

8. The origin and functions of water.

9. A water cycle in the biosphere, driving forces. Connection of hydrosphere with a condition of lithosphere and atmosphere.

10. Sources and consequences of hydrosphere pollution:

— Thermal pollution;

— Pollution by chemical and toxic substances. Eutrophication of water reservoirs.

11. The diseases connected to ecological trouble of hydrosphere (infectious, toxic).

12. Bioindication. Maximal concentration limit.

AUXILIARY MATERIALS TO THE THEME

Biological Resources. The natural environment in relation to the man carries out three basic functions:

— Economic — provides a national economy with resources;

— Biological — provides physical health of the man;

— Social — provides spiritual development of the man and society as a whole.

Biological resources (BR) — all living components of biosphere with genetic material in them. BR quantitatively are renewable, but are qualitatively practically nonrenewable resources.

Kinds of BR:

1) Resources of producers.

2) Resources of consumers.

3) Resources of reducers.

BR are used:

1 — as energy sources, raw material and materials;

2 — direct as object of utility;

3 — as bank of genetic fund or sources of the information about world around.

Secured Natural Territories

There are especially secured natural territories which represent places for sharply limited or specialized use.

They are intended:

- 1 — for maintenance of ecological balance and protection of ecological potential of region (including environmental territories);
- 2 — preservations of a genetic variety vegetative and animal world;
- 3 — organization of scientific data about a processes in the nature and influence on it of anthropogenous factors;
- 4 — promotion to ecological education and training.

Kinds of especially protected territories:

- 1 — reserve; 2 — sanctuary; 3 — national park.

RESERVE — area especially protected by the law or tradition which is completely excluded from any economic activities (including visitings by people).

SANCTUARY — a site, within the limits of which (constantly or temporarily) some kinds and forms of economic activities are forbidden.

NATIONAL PARKS represent the valuable natural territories used in the research purposes, and also for recreational and general educational tourism.

Recreational resources — the part of natural and cultural resources providing rest as means of maintenance and restoration of workability and health of people. To recreational resources concern national parks, city and suburban green zones, resorts, etc. places, suitable for rest.

The Atmosphere

The atmosphere is the gas environment of the Earth, the disperse environment, consisting of a gases mix (nitrogen, oxygen, carbon dioxide, inert gases), the suspended aerosol particles, water vapour. It rotates together with our planet, therefore atmosphere is in constant movement.

Layers of an atmosphere: troposphere, stratosphere, mesosphere, thermosphere (ionosphere) and exosphere. Three atmospheric areas contain ozone: troposphere, stratosphere and mesosphere. Problems of stratospheric and tropospheric ozone most sharply significant.

The basic function of stratospheric ozone is defence all living organisms from Sun rigid UV-irradiation (length of a wave of 200–320 nanometers).

Molecules of ozone as impurity to air are present at all heights from a surface of the Earth up to 100 kms, the maximum quantity of ozone molecules are at heights 15–30 kms which figuratively name «Ozone layer».

The sunlight with length of wave less 200 nms them is well absorbed by ozone molecules at the big heights not reaching up to stratosphere. With increase in length of a wave the factor of absorption quickly falls.

Tropospheric ozone as against stratospheric highly toxic composition for objects of the environment. Along with carbon dioxin tropospheric ozone absorbs infra-red radiation from the ground, playing an essential role in creation of a hotbed effect. The mankind has faced the challenge the phenomenon called «ozone holes», i.e. sharp decrease of the contents of ozone during the spring period above Antarctica that will cause strengthened penetration rigid UVR up to a Earth surface.

Sources of Pollution of the Atmosphere

Divide on natural and anthropogenous.

Natural sources:

- A space dust;
- Eruption of volcanos (convulsion of nature);
- Dusty storms;
- Thunderstorm activity;
- Rock erodes;
- Products of living activity of organisms.

Anthropogenous sources:

- Industrial emissions;
- Firing;
- Transport exhaust;
- Agriculture (use of fertilizers, use of chemical pest-killers);
- Radioactive pollution.

The greatest value in atmosphere pollution have: carbon oxides, nitrogen, the sulfur, flying organic compositions (FOC), compositions of heavy metals, industrial dust, soot, radioactive substances.

The atmospheric precipitation characterizing by strongly acid reaction, refer to as acid rains or acid precipitation. The main sources of one are fluid combustion, shale oil, coals, gas in the industry, agriculture, in private life. Sulfur oxides, nitrogen, carbohydrates interact with water and turn into solutions of a mix sulfur, sulphuric, nitrous, nitric and carbonic acids. Acid presipitations render direct and indirect action.

The photochemical smog — a multicomponent mix of gases and aerosol particles of the primary and secondary origin. The structure of the basic smog components includes ozone, nitrogen oxides and sulfur, organic compositions — peroxidates, named photooxidizers. Photochemical smog results from photochemical reactions under certain conditions:

- Presence in the atmosphere of high concentration nitrogen oxides, hydrocarbons, etc.;
- Intensive solar radiation;
- Calm;
- The high temperature inversion.

Nitrogen oxide interact with olefins of exhaust in result ozone excess are formed. In turn ozone interacts with olefines in result in atmosphere peroxides concentrate. They in sum form photooxidizers. Such phenomena — not rare phenomenon above London, Paris, New York, etc.

Hydrosphere

Hydrosphere name complex of all waters of the Earth: continental (superficial, soil, deep), oceanic and atmospheric.

Water occupies almost 3/4 Earth surface making the seas and oceans. Water resources consist about 1,4 billion cube km. Salty sea water makes of all huge resources of water about 98%, and fresh water — more than 2% of all world reserve, about 70% of fresh water is concentrate in glaciers and is inaccessible for man.

Sources of Ecological Trouble of Hydrosphere

1. Atmospheric waters. For example, 1 rain drop (weight 50 mg) falling from height 1 km washes 16 l of air. So various polluting substances will be easily washed out from air. As example, washing out of radioactive substances from the atmosphere resulted to spotty pollution of Republic Belarus territory after accident on Chernobul atomic station. Many gaseous compositions being dissolved in the atmospheric moisture form acid precipitations which break ecological balance of ground and water ecosystems.

2. Regulated run-off of the rivers by hydroconstruction leads to slowing down of rivers (reservoir storage). Slow sites of the river worse self-purify since the quantity of the dissolved oxygen necessary for processes of aerobic decomposition organic pollutants is reduced. At saturation of water by biogenic elements (eutrophication) begins mass development of phytoplankton, especially cyanobacteria (blue-green seaweed) — source of dangerous toxins.

3. The city sewage including domestic and municipal drains contains mass of organic substances, detergents (washing-up liquids), microorganisms, including pathogenic. Drains of infectious branches of hospitals are especially dangerous if they are not cleared and not disinfected.

4. Agriculture: sewage of farms, hen houses, use of mineral and organic fertilizers, pesticides.

5. Industrial sewage. With sewage in reservoirs is removed the huge amount of chemicals:

- Mineral oil;
- Toxic waste;
- Compounds of heavy metals;
- Pesticides;
- Washing-up liquids;
- Aromatic hydrocarbons;
- Nitroso-compounds;
- Radioactive substances.

Deficit in water of fluorine (less than 0,5 mg / l) conducts to caries. Endemic caries diseases occur in Belarus, Khabarovsk, Sochi, Kaunas, Arkhangelsk. Surplus of fluorine results to fluorosis (Tver, Tambov, area of South-East Asia).

Direct correlation between the contents of copper, cadmium, nitrates and level of cardiovascular diseases is proves to be true. Use very much hard water (2–2,5 g/l) renders negative influence on development of fetus, causes a pathology of secretory system, disease of a gastrointestinal tract.

Very much frequently the mineral structure of water is caused by anthropogenous activity. High concentration of nitrates meets in potable water as consequence of pollution by nitric fertilizers. Nitrogen-containing compositions in water are capable to turn in cancerogenic nitrosoamine promoting occurrence oncologic deasises of gastrointestinal tract.

Disinfecting of drinking water by chlorine is a source of formation in a waterpipe of dioxines — of the strongest toxic composition for warm-blooded organisms.

Oil and mineral oil cover a surface of water with a layer that breaks processes of photosynthesis and allocation O₂ phytoplankton, the water exchange and gas exchange between the atmosphere and hydrosphere is broken. Heavy metals, poisonous, hydrocarbons suppress living activity of water organisms, breaking processes of self-purification of a reservoir or causing extinction of the whole groups of organisms.

The first country which has felt negative influence of chemical pollution of the natural environment began Japan. In this country over 80% of territory is pressed direct influence of industrial production. Examples with « Minamata illness » (intoxication by mercury) and « illness Itai - Itai » (poisoning with cadmium), arisen are characteristic as a result of wastes discharge of industrial enterprises.

Contact of the man to hydrosphere passes three ways:

1. Through respiratory tract;
2. Through a gastrointestinal tract;
3. Through the skin.

Methods of Bioindication:

— Passive monitoring — among freely living organisms visible physiological and biochemical damages or deviations from the norm being are investigated by attributes of stressful influence;

— Active monitoring — at the tests — organisms which are taking place in researched territory in standardized conditions the same changes try to find out as in freely living organisms.

Bioindicators of pollutants are used at active monitoring:

Components of pollution	The bioindicator	Symptoms of influence
Ozone	Tobacco, spinach, grapes, string bean	Necrosis the top side of leaves, reduction of the contents of chlorophyll
Combination of harmful substances in air ions P, Pb, Zn, Cd. Mn, Cu RN Sr-90 and Cs-137	Sheet and bushy lichens, fir, fur-tree, pine, bee melliferous, sheet of cabbage, hourse-hestnut	Reduction of the contents of living cells of seaweed, reduction of the contents of a chlorophyll, top necrosis of needles, accumulation in honey
Chlororganic composition (PCD)	Reindeer and the Icelandic moss, eggs of sea and daytime birds of prey	Accumulation in dry substance, thin shells, destruction of eggs
H ₂ SO ₄ (acid rains)	Coniferous	Reduction of chlorophyll

Indicators can be not only complete organisms or their systems, but also their most sensitive structures on the basis of which biosensor controls are created. They are based on ecologically safe natural components. The biosensor system will consist of a biological element of recognition of polluting substances and the measuring device providing transfer of signal.

Biosensor controls are suitable for definition of toxic and mutagen substances, phosphoorganic substances, chlorinated hydrocarbons.

Sensor devices are created and used for measurement of biochemical parameters of agricultural crops, qualities of production of the food-processing industry (a sensor control of glucose — on a basis ferrocene — for the control of meat freshness, a sensor control peptides — for the control of process of milk proteins hydrolysis).

Biosensor controls was extended in the defensive industry in manufacture of the chemical and bacteriological weapon, the control of life-support systems in submarines.

Bioindication — a method of estimation abiotic and biotic factors of a habitat by means of biological systems. **Bioindicators** — organisms or their communities, which vital signs are closely connected to the certain factors of environment.

TEST

Variant 1

1. What gases in the atmosphere are least sensitive to anthropogenous activity?
 - a) carbonic gas;
 - b) nitrogen;
 - c) oxygen.
2. What is concern to anthropogenous sources of atmosphere pollution?
 - a) firing;
 - b) test of the nuclear weapon;
 - c) space dust.
3. The ozone layer in a stratosphere it is....
 - a) the top border of biosphere;
 - b) source of formation of acid precipitation;
 - c) filter from a rigid UV-irradiation.
4. What compositions do participate in destruction of ozone layer?
 - a) carbonic oxide;
 - b) ammonia;
 - c) freon (chlorine fluorine carbohydrates);
 - d) SO₂;
 - e) NO₂;

5. What biological consequences of ozone layer destruction do you know?
 - a) oppression of immune system;
 - b) activation of peroxidate oxidation of lipids;
 - c) changes in the nucleinic acids conducting to mutation.
6. Water resource on the Earth
 - a) are limited;
 - b) are not limited;
 - c) uninterruptedly are replenished in significant volume.
7. What does influence on ecological condition of hydrosphere?
 - a) ecological condition of lithosphere;
 - b) city sewage;
 - c) change of river flow velocity.
8. What does occur at eutrophication of water reservoirs?
 - a) the reservoir gradually turns to a bog;
 - b) the maintenance of organic substances raises in water;
 - c) the maintenance of oxygen raises in water.
9. What consequences of biological action of rigid ultra-violet radiation?
 - a) level of infectious diseases increases;
 - b) number of patients with a cataract increases;
 - c) number of patients with a skin cancer increases.
10. What action on human organism is rendered with acid precipitation?
 - a) cause predisposition to allergic reactions and diseases;
 - b) cause methhemoglobinemia;
 - c) influence on the upper respiratory ways (bronchospasm, asthmatic attacks, aggravations of bronchites).

TEST

Variant 2

1. What gases in the atmosphere most sensitive to anthropogenous activity?
 - a) CO₂;
 - b) nitrogen;
 - c) oxygen.
2. What concerns to natural sources of atmosphere pollution
 - a) firing;
 - b) test of the nuclear weapon;
 - c) space dust.
3. The ozone layer in a stratosphere is...
 - a) the top border of biosphere;
 - b) source of formation of acid precipitation;
 - c) filter from a rigid UV-irradiation.

4. What compositions participate in destruction of ozone layer?
 - a) carbonic oxide;
 - b) ammonia;
 - c) freon (chlorinefluorine carbohydrates);
 - d) SO₂;
 - e) NO₂.
5. What biological consequences of ozone layer destruction do you know?
 - a) oppression of immune system;
 - b) activation of peroxidate oxidation of lipids;
 - c) changes in the nucleinic acids conducting to mutation.
6. Consequences of «hotbed» effect as global environmental problem on a planet can be ...
 - a) redistribution of water on a planet;
 - b) change of natural zones borders of vegetation;
 - c) global decrease of temperature on Earth.
7. What from listed it is possible to relate with predecessors of acid precipitation?
 - a) ammonia;
 - b) SO₂;
 - c) nitrogen dioxide.
8. The ozone cloud of an atmosphere it is ...
 - a) the upper border of biosphere;
 - b) area in which the maximal quantity of ozone molecules is concentrated;
 - c) filter of the planet.
9. What is the bioindication?
 - a) a method of abiotic and biotic factors estimation of dwelling place by means of biological systems;
 - b) organisms or their communities which vital signs closely correlate with the certain factors of environment;
 - c) a method of estimation of quality of an inhabitancy with the help of biological systems.
10. Pollution of atmospheric air dioxide sulfur causes:
 - a) irritation of mucous membranes of the upper respiratory ways at the population;
 - b) formation of carboxyhemoglobin at people;
 - c) formation of smog consisting of a mix a smoke and a fog sated with acid.

TOPIC 3: ECOLOGICAL AND MEDICAL CONSEQUENCES OF LITHOSPHERE POLLUTION. ENVIRONMENTAL CONDITION AND POPULATION HEALTH

Total time: 4 hours

URGENCY

As a result of man activity the environment constantly become dirty. It is not simple xenobiotics entering but also the infringement of circulation of substances connected to it in ecosystems conducting to their destruction. The biosphere contains not along but some harmful chemicals more often therefore the influence of pollutants is complex. There are such harmful factor as ionizing radiations. At the combined action of xenobiotics and ionizing radiations are observed shifts in functional condition of the organism. The most widespread type of adverse influence of environmental factors is chronic nonspecific action on the organism.

The most important — xenobiotics are included in ecological food chains. With each part of a food chain the quantity of them increases for one, two order. At the end of a chain concentration of chemical in an organism can be increased in hundred thousand times in comparison with its contents in the environment.

Besides global environmental problems (destruction of the ozone layer, the phenomenon of «hotbed effect», acid rains and fogs, radioactive pollution of Belarus) exist also specific, regional, complex and critical very often.

THE PURPOSES OF LESSON

1. To get acquainted with a soil structure, features of Belarus soil. To give the characteristic of anthropogenous sources of soil pollution; to consider ecological consequences of lithosphere pollution. To show connection between character and a degree of lithosphere pollution and morbidity of the population.

2. To consider biological and environmental problems of nutrition; concept about contaminants foodstuff (pesticides, fertilizers, salts of heavy metals, cancerogenic substances, mycotoxins). To show the interrelation between the contents contaminants in food stuffs and morbidity of the population especially children one.

3. To familiarize with the norm-legal bases of preservation of the environment working in territory of Belarus; to show modern approaches to a legal estimation of actions of physical and juridical persons in observance of environmental regulations.

PROBLEMS

1. Definition of real loading on the man of the chemicals acting with food. To show interrelation between the maintenance pollutants in food stuffs and morbidity.

2. To determine the maintenance of the some contaminants (in particular nitrates) in food stuffs. To show modern approaches to the analysis of environmental quality; value of monitoring in life of a modern society.

3. To carry out eco-hygiene inspection of the objects which are taking place in territory of Gomel and Gomel area, to draw up results of research.

VOLUME OF INDEPENDENT WORK OF STUDENTS

— To fill in the table «Harmful substances and their influence on organism», showing interrelation between present in an environment pollutants and illnesses.

— To show presence of connection between character and a degree of environmental contamination and morbidity of the population.

— To carry out eco-hygiene inspection of the objects which are taking place in territory of Gomel city and Gomel area, to draw up results of research, to give recommendations on improvement of ecological conditions on the given object.

THEMES OF REPORTS

— Ecological and medical problems of environmental contamination by heavy metals.

— Cancerogenic substances in the environment.

— The risk estimation for posterity in connection with influence of chemicals during pregnancy.

— Environmental problems of clean foodstuff industry.

— Use of food supplements in food stuffs.

— The foodstuff contaminants.

— Detoxication of xenobiotics in the organism.

— Influence of a chemical compound of potable water on human health.

— Influence on the human organism of various components perfume and cosmetics.

— Endemic diseases.

— Smoking: the individual form of air pollution.

THE CONTROL OF PRIMARY LEVEL OF KNOWLEDGE

For full mastering a theme it is necessary to repeat from:

1) microbiology — «Microflora of soil. Epidemiological role of soil», «Microorganisms of foodstuff. Sources of contamination by microbes of objects of the environment. Normal microflora of the man»;

2) general chemistry — «Metals and their connections. Insecticides, use of their in the agriculture. Aldehydes. Amins. Nitrozamins, their cancerogenic action. Mineral substances of food»;

3) medical biology and genetics - «the Role of nutrition in man variability in different geographical zones. Physiologically balanced nutrition»;

4) biochemistry — «Mechanisms of xenobiotics neutralization in the organism. Value of genetic predisposition to metabolism disorder. The basic mechanisms of metabolism regulation».

CONTROL QUESTIONS FROM RELATED SUBJECTS

1. What epidemiological value has the soil? To cite smth. as the examples.

2. Name microbiological criteria of soil impurity level.

3. List sources of contamination by microorganisms of soil.
4. What you know the diseases are connected to deficiency of microcells in food and water? What from them do meet in Belarus?
5. What role does play insecticides used in the agriculture in human pathology?
6. What toxic action does make compositions of mercury and lead?
7. What biochemical mechanisms of xenobiotics neutralization in organism do you know?

THE BASIC QUESTIONS TO LESSON

1. Common characteristic of soils. Concept about a soil absorbing complex, humus.
2. Features of soils in Belarus.
3. Biogeochemical provinces. Concept about endemic diseases (endemic [adenomatous] goiter, caries, fluorosis, molybdenum podagra, Kashin-Bek disease (endemic osteoarthritis) etc.).
4. Biological and environmental problems of nutrition. The basic contaminants of foodstuff: mineral fertilizers, compositions of heavy metals, radionuclids, pesticides, fodder additives, aflatoxins, food supplements.
5. Xenobiotics and diseases of the population. Detoxication of xenobiotics, the mechanism of detoxication. Prevention of entering of harmful chemicals in food stuffs as a hygienic problem.
6. Ecological condition of air in large cities, water resources, a soil cover in RB and morbidity of the population.
7. Ecological condition of food stuffs. Contaminants of products and its connection with population morbidity.
8. Norm-legal basis of preservation of the environment. The state system of security actions. Rights guarantees of the nationals in healthy and favorable for life environment.

AUXILIARY MATERIALS ON A THEME

Litosphere — the top firm part of the Earth (crust). Living organisms are possible to meet deep into is lito-biosphere about 2–3 kms.

Soil is the superficial layer of an earth's crust formed under action of a climate and living organisms (vegetative and animal) and cultivated by the man. It is one of the major natural resources.

The basic soil types почв in Republic Belarus:

— sod-podzol (63,5%);

— sod-podzol c.-x. (14,3%) and also their various combinations.

The structure of soil (S) is non-uniform. The uppermost horizon (layer) of soil — humus. **Humus** (H) — organic substance of complex structure: (includes humic acids, lignine, cellulose) .One is formed during biological decomposition (transformation) of the vegetative and animal rests, products of live activity of organisms.

Humus functions:

- Provides plants by micro-and macro-with elements;
- Preserves the moisture in soil;
- Connect of heavy metals;
- Neutralize many toxic substances of a natural and anthropogenous origin.

From the physical and chemical point of view soil-heterogeneous colloid — disperse system. Its basis are soil colloids which more in chernozems (black earth) and peatbog and less in sandy soil.

Soil Absorbing Complex (SAC) — complex of soil colloids capable to exchange reactions with cations and anions from a soil solution, i.e. at first appear process of cations sorbtion before full saturation of colloid particles, and then if cations are much go cation-exchange processes.

Natural surplus or defishieny of a chemical elements of soil name the **Natural Biogeochemical Province**. Presence of a province usually results in occurrence of diseases specific in the given district which name endemic (endemic [adenomatous] goiter, caries, fluorosis, molybdenum podagra, Kashin-Bek disease (endemic osteoarthritis) etc.).

The most typical example for our Republic is the biogeochemical province in iodine. Sod-podzol soil — the most typical for RB are poor by I. Turfy and sod-podzol soils contain much enough I however it one is strongly connected by organic components and badly passes in plants. Except for that in ours soils not enough Zn, Co, Se and Cu which are co-factors of the enzymes participating in synthesis of thyroid hormones (+ anthropogenous influence). In places of soil pollution by exogenous substances arise the **Artificial Geochemical Province** which is characterized by the increased diseases and also disorder of psycho-physiological development of children.

Sources of Soil Pollution

1 Agriculture:

- pesticides, fertilizers, other agricultural chemicals;
- sewage and refuse of animal industries.

2. The industry thermoelectric, power stations, transport:/industrial sewage; - gas-dust emissions to the atmosphere; refuse/.

3. Household activity: economic — household sewage; refuse.

Protection of soil essentially differs from protection of air and water, since.

- 1) ground — the inactive environment;
- 2) there is a process of migration pollutants more slowly;
- 3) xenobiotics well accumulate;
- 4) is expressed indirect action on the man.

Xenobiotic (from Greek — xenos — another, bios — life) according to Stedman's dictionary is «substance non-endogenic origins acting as toxin». At present time becomes frequent uncontrollable dissimulation XB of anthropogenous

origin in the human inhabitancy, that adversely influences on population, reduces parameters of sanitary-epidemic well-being of the population.

The reasons of dissimulation XB:

- Objective laws of the nature.
- The human factor.
- The technical factor.

Process dissemination of XB includes three components:

- Direct damaging action of XB on a population or separate individuals. The result depends on the size of a «pathogenic» dose of XB expressed LD₅₀, a way of entry into organism, a condition of the organism, etc.;
- Cumulative damaging action of XB as consequence of it can be acute or chronic influence;
- Repeated damaging action of XB.

The system of protection of the population from adverse influence of XB should be on the basis of results of epidemiological diagnostics, i.e. it is important to find out the mechanism of influence of the pathogenic factor on disease and also to find in it such parameters which it is possible to influence accessible actions.

To xenobiotics concern:

1. a) microorganisms and their metabolites (bacteria, viruses, rickettsia);
b) mycotoxins;
c) storehouse wreckers;
d) parasites
2. 1) Poisonous substances: (pesticides; salts of heavy metals; migrants from packing) (table 1).
2) Extraneous mechanical impurity: (mineral, metal, dirt plants, etc.).
3. Radionuclids.

Besides during assimilation of usual nutrients in the organism is formed much biologically active metabolites, for example, biogenic amines (tyramine, triptamine, histamine, serotonin, adrenaline, etc.) which in case of accumulation can render abiotic action.

Consequences of acute or chronic action on an organism of xenobiotics acting with food are qualified as the food poisonings caused by xenobiotics, chemo-xenobiotic, and affection by radio-xenobiotic

The group of bio-xenobiotic poisonings includes poisonings of microbial, fungous, vegetative and animal origin; in group of chemo-xenobiotic poisonings — poisonings with pesticides, nitrosamines and salts of heavy metals, in group of radio-xenobiotic affection-radionuclides of natural and anthropogenic origin.

Our food contains more and more undesirable toxic impurity of the anthropogenic origin. Not all foodstuff are polluted to the same degree. In the table are submitted the most polluted foodstuff of vegetative and animal origin, sources of pollution of products and contaminants of foodstuff.

The table 1 — Classification of chemical contaminants

Contaminant	Source of pollution	Product
Lead	Exhaust, firing of coal, industry of lead, the soldering of cans seams, the brown ware covered with lead glaze	Grain crops, vegetables, tinned milk, tinned fish, sour products
Cadmium	Precipitation in water drains, processes of fusion	Grain crops, vegetables, meat
Arsenic	Processes of fusion	Milk, vegetables, fruit
Mercury	Industry of chlorine, alkalis, means for seeds processin	Fish
DDT and halogeno-hydrogens	Pesticides	Fish, human milk
Polychlorine-biphenyl (PVC-BP)	The electrotechnical industry	Fish, human milk

About 70% of lead the man receives with food. Allowable contents of lead in meat, sausage no more than 0,5 mg/kg, in eggs — no more than 0,3 mg/kg, in dairy products — no more than 0,1 mg/kg. Even small regular entry of lead to organism results in chronic kidneys disease, etc.

Sources of cadmium entry to human organism with food are following: meat products, game, fish — 39 %, grain crops — 22%, potato and vegetables — 20,2%, fruit — 10,3%. pH of soil, kind of a plant, intensity of soil processing influenced on biological cadmium accumulation in soil and plants. Deciduous green vegetables are natural cadmium accumulators.

Xenobiotic detoxication is realized by different ways. One of problems of free oxidation is xenobiotic transformations. They are carried out by enzymes dioxygenases and monooxygenases. Oxidation proceeds at participation of specialized cytochromes located in endoplasmic reticulum more often, therefore this process refers to still cytochromes as oxidation. In reaction of free oxidation participates oxygen and regenerative respiratory carriers. As electrons acceptor is cytochrom P-450. The biological role of these processes consists in the metabolism of some natural and xenobiotic substratum. Xenobiotic hydroxylation during free oxidation makes easy destruction and removing from the organism. Their neutralization in a liver occurs by oxidation, methylation and conjugation with those or other substances. Detoxication can realized by «rotective» synthesis also, for example, urea synthesis in result neutralizes ammonia, glucuronic acid participates in neutralization of products of proteins putrefaction. At consumption by molluscs, oysters, liver and kidneys of agricultural animals in their organism the cadmium contents run up. Cadmium is the most dangerous metal. Allowable cadmium levels in meat is no more than 0,05 mg /kg.

According to SanR&N 1163 RB 98 the maintenance arsenic, mercury, copper, zinc in food is normalized also.

Special attention is given to studying of action of ecologically dangerous chemical factors. Must be taken into account their kinetics features, a metabolism, biotransformation, cumulation and concentration; movement into food net; carry and transitions from one environment into other; opportunities of transformations in secondary pollutants; influence on the various organisms which are included in ecosystems. Is supposed that in the beginning of 21 centuries chemical industry in the world will increase approximately to double already. Today in data bank already there are about 8 million various chemicals.

Pesticides

This collective name of protective chemical means for plants against harmful microorganisms, plants and animals. Pesticides (Ps) are jointed in 450 chemicals. In RB is applied more than 130 Ps. Ps are capable to cumulate in the environment and to be transferred into parts of food net.

The ultimate effects caused by pesticides:

- Cancerogenic effect; gonado-toxic action (damage of gonad gland structures at both sexes) as consequence occurs infringement of reproductive function; teratogenic and embryotoxic action.

Heavy metals

Environmental contamination by metals, as a rule, is great near to large industrial complexes especial near chemical industry. As example of such territory is the Novopolotsk industrial region. Large industrial complexes are concentrated on rather small territory on the basis of oil pipeline «Friendship». In the given region there is an intensive metals accumulation: nickel, cobalt, vanadium, manganese, titan, lead, copper, etc. Are found out local sites where concentration of metals in soil 10 times more their average maintenance in the earth's crust. The microcells unbalanced maintenance in a landscape is capable to cause various diseases in people. So nickel promotes occurrence cancer; cobalt increases erythrocytes quantity, causes the inflammation of a nose mucous membrane; copper — a liver cirrhosis; the titan and zirconium act on system of the top respiratory ways and can reduce hemoglobin quantity; mercury — on central nervous system.

Consequences of soil pollution

1. Process of soil formation is inhibited.
2. Soil productivity is considerably reduced, consumer qualities of plants are reduced.
3. Self-purification of soil, i.e. ability to decompose pollutants till assimilable by living organisms and substances involved in circulation are weakened. In such soil pathogenic microorganisms survive longer.
4. Pollutants accumulation in plants and further pass into human organism with throphoc chain. Accumulation in plants is determined by factors:
 - a) In the speed of transition into plant (depends on a kind of a plant, physical and chemical pollutant properties, its concentration in soil, physical and chemical structure of soil);

b) Decay rate in a plant is usual 3–5 times more slowly, than pollutant decomposition in soil.

Belarus occupies the area of 207,6 thousand km², average population density is equal 49 man on 1 km² that is rather low parameter according to European standards 67% of the population approximately lives in cities. A climate of Republic is soft continental. Belarus has significant reserves of potash and stone salts, peat, cement raw material, forming and glass sand, refractory clay, oil, dolomite, granite, sandy-gravel mixes, building materials, mineral waters.

The Republic specialized on labour-intensive sectors, including mechanical engineering, the textile industry, woodworking, manufacture of meat-and-milk production. Besides Belarus became the significant manufacturer of mineral fertilizers, basic chemical and petrochemical production.

In Republic there was an adverse ecological and sanitary-and-hygienic situation. To its development have resulted the negative phenomena which have collected for decades in environment, established consumer approach in use of natural resources, departmental interests at accommodation of established production capacities, accident with Chernobul atomic electricity station.

High concentration of industrial and production potential has resulted to that on a share 11 from 210 cities (Minsk, the regional centers, Bobruisk, Orsha, Pinsk, Baranovichi, Borisov) has 70% of an industrial output, 65% of industrial and production potential, 62% of city population and 39% of all population of Republic. Therefore in some cities and areas of Republic difficult specific complexes of environmental problems were generated:

1. Zone of accident with radioactive pollution of area.
2. Area of Soligorsk industrial center.
3. Cities with a high level of industry concentration polluting the environment.
4. Area of Poleskoj lowland.
5. Areas of lakes Naroch, Osveiskoe, Chervonoe and Braslavskie lakes.
6. The locations of large cattle-breeding complexes.

Maintenance of the safe environment right of citizens is defined by the Constitution of Belarus, by socially oriented legislation at environmental problems basis of which is the Law of Belarus «About protection of the natural environment» with the combination to a complex of already accepted and accepting acts in the field of environment preservation and principles of nature management.

Main principles of the Concept of public policy in the field of preservation of the environment are:

- 1) A state ownership on all kinds of the natural resources, a providing opportunity of their transfer on the basis of the corresponding legislation in constant or temporary use to separate juridical and physical persons. Exception is the soil as a special kind of natural and economic resources which can be in state ownership and a private property;
- 2) Preservation of the environment, objects of the living and lifeless nature in all territory of Republic in a combination with creation of system of

especially protected natural territories, i.e. territories completely or partly derived from economic use in the nature protection purposes;

3) Legislatively provided system of the state control of environmental condition financed from the state budget, protection and use of natural resources, quality of food stuffs, safety of industrial and agricultural production for environment and health of the population with obligatory division on all parts of system control and nature management functions;

4) Legislatively provided system of multistage state ecological examination of the projected, builded and maintained economic objects, confirmed with the economic and legal liability at default its requirements or ignoring carrying out;

5) Bringing to business of environment preservation and the condition control over its of the population, public organizations and movements; support at the state level of public organizations engaged in problems of environment preservation, human health, protection of the living and lifeless nature;

6) The economic mechanism of maintenance of the environment preservation include:

- Payment of the nature management for using all kinds of natural resources, dumps and emissions of polluting substances to environment and accommodation of waste products and allowing as except for free-of-charge using citizens some kinds of wild-growing vegetative resources (gathering of mushrooms, berries, etc.);

- Lax credit and the taxation of nature protection activity, construction of nature protection objects, including lax credit from off-budget funds of nature protection;

- State level support of the enterprises and the organizations of all patterns of ownership engaged in problems of natural resources economy, energy-saving, processings and utilization of industry and consumption waste products;

7) System of measures of the criminal and administrative responsibility for infringement of the nature protection legislation under condition of obligatory compensation of the damage to urban population health, to property of physical or juridical persons at the expense of the breaker;

8) Perfection of legislative base, system of compensation of losses guilty of environmental contamination at municipal and interstate levels;

9) Participation in the decision of global environmental problems, including:

- Preservation of a biological diversity;

- Protection of an ozone layer;

- Prevention of anthropogenous climate change;

- Protection of woods and forest regenerating ;

- Development and perfection of system of protected natural territories of a various rank and purposes;

- Regulations of trade by rare and are in the verge of destruction kinds of animals and plants.

THE LITERATURE

1. Stadnitskij, G. V. Ecology / G. V. Stadnitskij, A. I. Rodionov. — M., 1988.
2. Pivovarov, J. P. Manual to laboratory researches on hygiene and bases of ecology of the human / J. P. Pivovarov . — Under edition. — M., 2001.
3. Stogarov, A. N. Ecological medicine / A. N. Stogarov. — Mn., 2002.
4. The Viennese convention on protection of an ozone cloud. — Vienna, 22.03.1985.
5. The law of Belarus «About preservation of the environment», 26.11.92.
6. Kiselyov, V. N. Foundation of ecology: textbook / V. N. Kiselyov. — Mn., 1998.
7. Korolev, A. A. Medical ecology: the Manual / A. A. Korolev. — M., 2003.

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