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Programm Abstracts

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CONTROL OF SOIL PURIFICATION FROM POLYCYCLIC AROMATIC HYDROCARBONS

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Great damage to soil is caused by pollution by foreign chemical substances. Over the last years, this pollution has been happening on a global scale. As a powerful natural sorbent, soil has the ability to accumulate various pollutants, by-products of many industries. Therefore, the development of methods for the reduction of toxic load in soils is a critical task.

It is well-known that the Laser-Induced Fluorescence (LIF) method of soil remediation makes it possible to create a quantitative evaluation of the remediation process and assess the state of the pollutant in the soil. At the same time, it is also possible to use LIF for the measurement (both field and laboratory) of the number of polycyclic aromatic hydrocarbons.

We have thoroughly analysed the existing control methods of soil purification from chemical pollutants, which enabled us to develop optimal methods for carrying out an LIF analysis when having limited material resources allocated for the measurement experiment, thus increasing the total performance efficiency of the LIF analysis system.

The analysis of numerous sources allowed us to detect a great number of factors which influence the general form of LIF spectra and appear under different condition of the conducted experimental studies.

We have realized an information optimisation of the LIF control system of soil contamination by polycyclic aromatic compounds.

The minimally achievable quantity of the measurement data in the system has also been evaluated.

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INVESTIGATION OF COMPLEX PROCESSING OF THE HARDENRICHABLE PYRITES-POLYMETALLIC ORE BY USE OF AUTOCLAVE OXIDIZING LEACHING METHOD

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In consequence of the decrease of easily enrichable polymetallic ores reserves there are drawn into processing the poor and hard enrichable ores. For this reason there are observed the increase of pyrites contents both in the ore and the products of its enrichment.

One of the richest color metals deposits of Azerbaijan Republic is Filizchay pyrites-polymetallic ore, located in the area of Belokan-Sheki metallogenic zone. Its mineralogical composition is: 77.93% pyrite, 4.85% galena, 7.45% sfalerit and 1.61% chalcopryrite. There are the main components (Pb, Cu, Zn, Fe, S) and the accompanying microcomponents (Ag, Au, Bi, Sb, Cd, Se, Co, Ga, In, As, Te, Tl and others) in composition of Filizchay ore, which are possessed of the industrial value.

Presented work is dedicated to the pyrrhotization of hardenrichable Filizchay pyrites-polymetallic ore in inert atmosphere and autoclave oxidizing leaching of pyrrhotitized product in the presence of gas-oxidizer- SO_2 .

Autoclave hydrometallurgy allow to intensify technology processes, increase direct extraction of metals, improve the selectivity of their separation, draw into the processing the raw materials of complex composition. In this connection rather actual is processing of hardenrichable pyrites-polymetallic ore by autoclave method.

Pyrrhotization of ore is performed for obtaining more reactionary pyrrhotite ($\text{Fe}_n\text{Sn}_{n+1}$) at break of crystalline lattice of pyrite entering the composition of investigated ore in the process of its termic dissociation. As a result of pyrrhotitizing ore, pyrite, chalcopryrite, arsenopyrite and other high sulphides decompose into low sulphides with the formation of elementary sulphur and arsenic. The received elementary sulphur and arsenic are sublimated. Sulphides of non-ferrous metals remain immutable.

An autoclave leaching of pyrrhotitized ore is carried out with use of lignosulfonate as surfactant, under high pressure at temperature not higher than the melting point of elementary sulphur (383K) for the prevention of occlusion of decomposed sulphides. In the process of autoclave oxidizing leaching of pyrrhotitized product, elementary sulphur is received simultaneously from two sources: sulphide sulphure of pyrrhotitized ore and from gas-oxidant (SO_2). High temperature and pressure of gas-oxidant (SO_2) promote increasing oxidation-reduction potential of solution due to what practically complete oxidation of pyrrhotite to ferrous sulphate (FeSO_4) must take place. Ferrous sulphate obtained in the process of autoclave leaching transforms into solution. Rare metals (Ga, In) entering into the composition of ore are not sublimated at the process of ore pyrrhotitizing and also transfer into solution at autoclave leaching of obtained product. The non-ferrous (Pb, Cu, Zn, Ag, Au) metals are concentrated in sulphur-sulphide solid residuum. Thus, selective separation of the non-ferrous metals from ferrum is provided.

The results of carried out investigations may be used for the basing and elaboration of processing of the other high pyritous polymetallic ore deposits of analogous to Filizchay ore deposit such as Ozeroye, Kholodinskoye (Russian Federation) Jayrem (Kazakhstan), Rammelsberg, Meggen (Germany), Maunt-Isa, Broken-Hill (Australia).

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HIGH ASH COAL BURNING IN THE COMBUSTION CHAMBER OF TPP IN KAZAKHSTAN

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The application of thermal engineering cause great interest and has a great value for practice. The importance and growing attention to the given problem is related to the importance of creation and modernization of existing combustion chambers that decrease quantity of the polluting substances released into the atmosphere and increase the energy efficiency.

The impact of the power enterprises in environmental contamination by products of fuel combustion and solid wastes is significant. First of all, due to power stations which work on solid fuel and are the basic contaminants of air, water and soil. The atmosphere in Kazakhstan contains hazardous substances such as carbon and nitrogen oxides, dust, lead, sulfur dioxide etc..

This problem can be solved only on the basis of physical, mathematical and chemical modeling using advanced technology. Thereby numerical experiment becomes one of the economic and convenient ways to make detail analysis of the difficult physical and chemical phenomena occurring in the combustion chamber of a specific power plant (TPS) and for any power fuel.

In this article we discuss application of 3-D modeling methods to study the processes of heat and mass transfer of burning power fuel in combustion chambers operating TPS. Using these methods we can on the basis of the solution of unsteady 3-dimensional Navier-Stokes equations taking into account a heat transfer, thermal radiation, chemical reactions and multistage of environment.

The coal-dust flame in modern combustion chambers in gas-dynamic relation represents three-dimensional (curvilinear) turbulent flows of compressed gas, moving in the conditions of burning and intensive heat exchange with surrounding surfaces. At construction of settlement schemes with reacting currents in furnace chambers, it is necessary to deal with difficult system of the nonlinear equations in the private derivatives, consisting of the conservation of momentum, mass and energy, motion of the viscous environment, distribution of heat and diffusion for a component of a reacting mix and reaction products. Besides, the given system contains the equation of state and the equations of chemical reaction kinetics, which determine intensity of nonlinear sources of energy and substance. This problem is further complicated due to the weak level of knowledge of the kinetics of chemical reactions and the difficulty in describing the turbulence.

Thermal engineering in Kazakhstan is aimed at using high-ash coals (to 55 %). Use of such coal leads to unstable burning, causes problems of slagging and protection of the atmosphere from the emission of ash, carbon oxide (CO), nitrogen oxides (NO and NO₂), sulfur dioxide (SO₂), connections of hydrocarbons, etc.

The authors of this paper examine the processes of heat and mass transfer by burning

fuel in the combustion chamber of industrial energy facilities with the main stages of burning coal: devolatilization, burning coke formation and degradation of harmful dust and gas emissions.

According to the results of computational experiments, the authors obtained new results of theoretical research, mathematical and computer modeling of turbulent heat and mass transfer from the combustion of pulverized coal in the combustion chamber of the boiler industry of Kazakhstan.

The results of computational experiments can be used in the design of new and improvement of existing combustors industrial boilers using solid fuels, as used models are the most complete, modern and optimal for a given level of development of science. This, in turn, would solve the problem at the same time intensifying the process of burning, energy consumption, increase efficiency of low-grade coal combustion and reduce harmful dust and gas emissions into the environment.

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NUMERICAL SIMULATION OF HEAT AND MASS TRANSFER IN THE PRESENCE OF PHYSICAL-CHEMICAL PROCESSES

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At present time, there is an increased interest to the study of heat-and-mass transfer in high temperature environments in the process of burning. These processes occur in strong turbulent and non-isothermal flows, multiphase fluids, in the conditions of significant impact of nonlinear effects of thermal radiation, interfacial interactions and multistage chemical reactions. Such phenomena are widespread, they play an important role in thermal processes, and their study is an actual task of macrokinetics, physics of combustion and explosion, and modern thermal physics.

To solve the problems of modern power engineering and ecology it is especially important to study the processes of heat and mass transfer in the high-temperature reacting media and to simulate physical and chemical processes that occur during the combustion of pulverized coal. These problems are related, on the one hand, to the concept of “energy safety” of the country and, on the other hand, to the development of processes of “clean” fuel combustion under strict standards of emission of harmful substances into the environment.

In the conditions of depletion of natural power resources and environmental pollution, the development of the theory of heat and mass transfer and implementation of technological processes with the rational use of fossil fuels, solution of the problems of economic use of power equipment, increase in the efficiency of energy generation and solution of environmental problems are actual and important tasks in numerous thermophysical studies in this direction.

Expensive experimental studies on reduced fire models do not strictly comply with all the conditions that correspond to the actual combustion process, as it is necessary to achieve the geometrical and physical resemblance of the objects and to observe basic parameters and operation conditions corresponding to the technological combustion scheme used at the real power facility.

Theoretical investigations of heat-and-mass transfer in the presence of physical and chemical transformations in moving high-temperature responsive environment also cannot answer all the questions. This is due to the fact that such flows are described by a complex system of non-autonomous nonlinear multidimensional partial differential equations corresponding to the transfer of momentum, distribution of heat, components of the reaction mixture and the reaction products, which must take into account a considerable turbulence, multi-phase medium and source terms related to chemical kinetics of the processes.

Analytical solutions of this complex system of equations have not yet been found, and they can be solved only numerically. Recently, the main methods used to study such processes, particularly in the areas of real geometry, are the methods of numerical modeling and on their basis numerical experiments that adequately reflect the actual physical processes occurring in the combustion chambers. Progress in the development of computational models, in the creation of efficient computational algorithms and problem-oriented software packages allows us to solve many problems that are of great practical application in various industries.

Therefore, it is important to carry out a comprehensive study of physical and chemical processes of heat transfer in the high-temperature environment. This study will be based on the achievements of modern thermal physics, the use of new numerical methods of 3-D modeling, construction of efficient computational algorithms and new computational models that enable scientists to describe with high degree of accuracy real physical processes that occur during combustion of power-plant fuels in the combustion chambers of operating power stations.

Olga Atamanova

ENERGY-SAVING AND WATER-SAVING TECHNOLOGIES IN WATER ALLOCATION OF IRRIGATION CHANNELS

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The problem of energy saving and resource saving is increasing in most regions of the world at present time. Tasks of energy resources supply, clean water, clean food are coming to the fore in many countries of the world.

Water saving is of particular importance in indigenous irrigation regions where irrigation indigenous plant and animal breeding depends entirely on irrigation. This is

important for areas where topographical and climatic conditions would be most useful to use irrigation systems of open type.

Irrigation systems consisted of open type canals are simple in construction and operation. However, the systems have a great defect as a large loss of water, leading to a gradual waterlogging and salinization of the soil. Irrigation regime violation leads to a decrease in yields of agricultural crops.

Automatic operation of water allocation can minimize water losses in irrigation systems. Automated distribution of open canals were developed at the end of the last century. Its control is ensured by the electrically operated gates. Management of these devices is carried out from the dispatching point located on the construction. Such systems are not energy efficient, because they spend a significant amount of electricity. The use of water distribution systems of the combined type is appropriate for energy savings and provide the required modes of operation facilities. Such a system is broken down into cascades of canals with hydraulic feedback thread in each stage. Network constructions are equipped with automatic gates of levels of water and intensity of flow. Solenoid valves are placed only on the master and the large distribution sites. It is best to use the hydraulic stabilizers of outlet discharge as a means of automation of water outlets, which are the most widespread systems of water allocation. The stabilizers are used for allocating canals given (maximum error $\pm 5\%$) the outlet discharge. Water flow regulators do not have parts that are moving while working. Therefore, the regulators are simple enough structurally, easy to manufacture and use. The use of these devices can provide irrigation water savings and significantly increase the efficiency of irrigation systems.

Flow regulator with a conical peak is one of the most sophisticated designs flow regulators (The Kyrgyz Republic Patent No. 1551. Water flow regulator / O.V. Atamanova, V.V. Kruglova (Matviets), 2013). The use of this and similar designs on the overflow of open canals of irrigation systems will improve the quality control of water distribution in the system as a whole.

Automatic level regulators of hydraulic action which provide a constant level of water in the canals by using the hydraulic flow properties are recommended to automate partitioning off. These are indispensable to the facilities away from sources of energy supply.

Improvement of water distribution systems on the principle of cascade regulation, including automatic regulators of levels and stabilizers (automatic regulators) of water consumption for automation of autonomous systems structures, will undoubtedly contribute to energy saving and resources saving in the implementation of irrigation events using open irrigation systems.

Such systems allow to minimize losses of uneven flow, solve the problem of irrigation water accounting in the market economy. The systems contribute to increasing reliability of installations for removing water and quality of functioning of irrigation systems.

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ELECTROCHEMICAL METHOD FOR OBTAINING HIGH PURITY SELENIUM

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The work deals with obtaining high purity selenium with by electrodeposition in refining process of selenium-product of slum processing of chemical combine (Russia). The researched technological selenium contained 99.62% Se. Cathodic method was proposed for electrochemical deposition of selenium. The process in most cases was performed from solutions of selenious acid. Electrode reaction corresponding to the process: $\text{H}_2\text{SeO}_3 + 4\text{H}^+ + 4\text{e}^- = \text{Se} + 3\text{H}_2\text{O}$.

Acidic electrodes of two type: I – $3\text{HCl} + 1.5\text{SeO}_2$ and II $3\text{NaCl} + 1.5\text{SeO}_2$ were used for deposition of selenium from selenoacidic electrolytes at $\text{pH} = 3 \pm 7.5$. Electrolysis was conducted at current density $1\text{--}60\text{mA}/\text{sm}^2$, temperature was changed at a range of $20\text{--}90^\circ\text{C}$, titanium cathode, graphite anode, cathode space was separated from anode space by glass filter No 2. At lower current densities (up to $5\text{mA}/\text{sm}^2$), temperature $20\text{--}40^\circ\text{C}$ at start time of electrolysis a dense film is deposited from electrolyte II on cathode from red amorphous and dark-red crystalline selenium mixture. At a range of current density $1\text{--}2\text{mA}/\text{sm}^2$ crystalline selenium is formed. At current density higher than $5\text{mA}/\text{sm}^2$ selenium amorphous modification is formed on cathode.

At higher densities of current $40\text{--}60\text{mA}/\text{sm}^2$, temperature $20\text{--}40^\circ\text{C}$ loose dendritic selenium deposits are formed on cathode. At similar conditions even at lower densities of current red amorphous selenium is deposited on cathode from electrolyte I. Formation of crystalline selenium is observed only at electrolysis of hot electrolyte ($70\text{--}90^\circ\text{C}$). Mechanism of electrode reactions of deposition of selenium from acidic solutions of electrolytes was researched. By this way selenium with 99.98% purity was obtained.

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INTERNATIONAL PROJECTS IN THE FIELD OF ENERGY EFFICIENCY AND ECOLOGICAL SAFETY IN THE URAL FEDERAL UNIVERSITY

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UrFU «Energy saving» Department has been cooperating with A.R.I.E.L. (Association for Research with Industrial and Educational Links) since 2007, which is a non-commercial organization created in 2000, with the Conference of Higher Engineering Schools of France (CGE), and also with other foreign organizations, for example, with Europäische Wissenschaftliche Gesellschaft (EWG Hannover).

Lately this cooperation has been directed towards studying and using international experience in educational activity, in particular – Presidential programme « Energy saving, raising energy efficiency and resource saving in industry», realized by UrFU in 2012-2014.

One of the large projects of A.R.I.E.L. Association is a Russian-French programme CODEST (Co-Development Science & Technology) of joint research-innovation projects, the aim of which is - implementation into the intergovernmental Russian-French programme, dedicated to the issues of energy efficiency and begun in 2007-2010 by a number of seminars in Russia (Ekaterinburg in particular) and in France, creative aspect (scientific environment) along with investment aspect (industrial environment).

Association A.R.I.E.L. holds the following principles, which we fully support and seek to accomplish realizing joint projects:

- There is no higher education without science,
- There is no science without innovations,
- There are no innovations without international challenge.

Very interesting and useful is the experience of the Centre of energetics and processes at Higher Engineering School of Paris Mines-ParisTech, which is headed by professor Didier Mayer, who is the chief of the CODEST programme from the French side.

In the French specialists' opinion, energy efficiency is a central factor in various aspects. Raising energy efficiency allows to directly decrease the production and consumption of primary energy, necessary to reach a certain goal, to provide energy independence, to reduce CO₂ emissions and therefore to lessen the urgency of the climate change and global temperature increase problem. Effective energy use approaches integration by means of improving the consumption provides capacity gain by approximately 20 %.

Energy efficiency of buildings and its influence on the environment has become one of the most topical social questions during last decades. In Europe, France, in Russia and in many other countries the forthcoming reduction of fossil fuels reserves leads to the necessity of conducting very tough policy in the field of energetics, energy saving and ecology, in the centre of which the building sector is regularly found to be.

As a variant of scientific, educational and technological cooperation joint project with the French party in the near-term prospect the development of CODEST-Ural programme is being considered, which will permit to realize a number of topical subjects, such as:

- Recuperation of energy in buildings,
- Effective ventilation of buildings with low power capacity,
- Isolating materials, adapted to Russian climate,
- Rational use of energy – «Smart energy» in buildings,
- Biomass usage,
- Modern heat exchange equipment and processes optimisation.

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MINERAL INDUSTRIAL WASTE - REINFORCEMENT FOR CONSTRUCTIONAL POLYMER COMPOSITES

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Nature management's formed and processing requiring waste can be useful in different industries. Constructional materials manufacturing of waste is one of the advanced waste reclamation directions. For today such type of large waste processing may become very expedient for our country, as vast number of waste materials amassed in Russia, at the same time construction volume increases constantly. Some large waste, for example, fine-grained waste of energy economy is valuable mineral for manufacturing of constructional materials.

High-polymeric-mineral composites manufacturing experiments series by extrusion technique were conducted in Irkutsk State Technical University. Suspension polyvinyl chloride was used as polymeric matrix. Thermal-power waste - Irkutsk Region thermal power plant furnace dust - was used as functional filler (reinforcing element). A new materials' production process researched after studying of minerals characteristic and capability assessment of that materials as filler for plastic.

Obtained material group have a good physicochemical and consumer properties' wide spectrum. Also flammability class put down from fillerless polyvinyl chloride highly combustible class (3 or 4 class) to researching materials low-flammable class (1 class). So that filler can use as constructional finish materials for the better part of room types.

The particulate filler reinforcement mechanism definition is important factor of obtained polymer mineral composites intent improving mechanical properties. Thereat reinforcement was influenced by many factors. The polymer particulate filled composites can be a laminated system. The system matrix is thermoplastic, which stratified on dispersion particles surface with strata alternation or filler particles. The polymer mineral composites samples microscopic research confirm of material stratiform structure, where furnace dust numerous particles include in polyvinyl chloride interlayer space.

Filler's influence on the researched polymeric-mineral composite physicochemical properties reinforcement is attributable to solid bit internal flaws distribution statistic theory. As such composites durability increase with the growth of active surface to a maximum, which conform to polymeric layer extreme orientation. Reinforcement by the particulate filler aligned with overtension alteration in apexes of crack with relax and stress redistribution on microcracking larger centers. Appeared in filled plastic microcrack "leans" on dispersed particle and as apt high effort is necessary to microcrack development. So the filler loading capacity increasing in polymer put more obstacles for cracking and that is blocking deterioration process.

Therefore based on polyvinyl chloride and furnace dust obtained polymeric-mineral

composite high physical integrity is attributable to characteristics and high content of the filler.

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THE USE OF BIOLOGICAL METHODS FOR CONTROL OF SOILS AT INDUSTRIAL WASTE LANDFILLS

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Landfills for storage of industrial waste are a source of increased environmental hazard. Complex biochemical processes of waste decomposition take place on their territory for long-lasting time, accompanied by formation of toxic organic and inorganic compounds. As a result, specific anthropogenic soils are formed in the landfill body, which may be much dangerous for the environment in virtue of their toxicity.

In this regard, the objective of our research was to make an ecotoxicological assessment of soils at landfills with solid industrial waste located in Leningrad Region, with the use of biological methods. The first object of research was a landfill (disposal area) containing sulfuric acid industrial waste. The total amount of waste is 120 thousand tons. The second object of research was a slag and ash disposal area storing a complex-composition body of slag and ash. The waste volume is 1200 tons. At present the operation of landfills has been stopped due to exhaustion of the resource. The sampling of soils for analysis was made in accordance with state standards, from the depths of 0-5 and 5-20 cm.

It is known that evaluation of ecological condition of contaminated soils on the basis of results of chemical analysis only is nearly impossible. This is due to a large number of pollutants and because the joint effect of contaminants is not considered, whereby the influence of each of them may deepen or weaken. Biological methods of assessment are in this case the only way to assess the cumulative toxicity of soils. Joint use of chemical-analytical and biological methods makes it possible, on the one hand, to increase the accuracy of the research, and on the other hand - to give an objective assessment of the ecological condition of the objects under investigation.

The chemical research has revealed an extremely hazardous extent of pollution of the disposal area soils with heavy metals, as evidenced by the figure of the aggregate metal contamination (Z_c) equal to 607 units. The ash-disposal soils had permissible extent of pollution, as estimated by Z_c (17 units). The content of such organic pollutants as 3,4 benzpyrene, petroleum products, polychlorinated biphenyls did not exceed the permitted norms in both landfills' soils.

The ecotoxicological research of soils was carried out with involvement of eluate and substrate methods of biodiagnostics, using test-organisms of different trophic levels: hydrocoles (infusoria and daphnids), higher plants (seeds), microorganisms (natural complex of microorganisms contained directly in soils). One of the methods where

seeds of *Triticum aestivum* are used as a test-organism was developed at the Ecological Security Centre (registration code of measurement procedure at the Federal Register - FR.1.39.2006.02264).

Based on the use of proposed set of biotesting systems, hazardous toxicity of soils in the disposal area (with sulfuric acid industrial waste) was revealed, and it was corresponding to an extremely dangerous category of pollution identified with chemical methods. The coincidence of results obtained through different methods proves the objectivity of the used biodiagnostics methods. The soils of the ash disposal area show a moderate extent of toxicity. In this case, the biological methods proved to be more sensitive in assessing the state of soils, than chemical methods. Thus, the proposed biodiagnostics criteria may be successfully used for assessment of environmental safety of soils at shut-down landfills.

B.A. Bazarov

UTILIZATION OF COAL WASTES FOR PRODUCTION OF CONSTRUCTION MATERIALS

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At present time, there is a vital necessity to increase utilization of solid wastes of coal mining and processing in Kazakhstan.

Multiple researches proved that it is possible to use coal-processing wastes in different manufacturing sectors. In terms of content of impurities in mine the most interesting thing for Karaganda coal-mining field is utilization of coal processing wastes as a raw material for production of construction materials.

It is assumed that mine-processing wastes are usable for brick production if they content 11-27% of Al_2O_3 . Research made by VUCIN and SRI of construction materials proved that it is possible to get wall ceramics and agloporites from wastes of Ore-Processing Plant No. 1 "Arcelor Mittal" JSC. Thus, in laboratory of KSIU 18-perforated brick (grade 150 and upper) was produced of coal wastes processed using gravitation method at OPP No.1 "Arcelor Mittal" JSC. Apparently, in order to get bricks of upper grades, it is necessary to degradate coal wastes more carefully and eliminate carbon. On the other hand, average carbon content in coal wastes about 20% provides sufficient sintering rate and productivity while producing agloporite. According to time specifications for coal processing wastes as a raw material for agloporite, elaborated by the Institute of Fossil Fuels (IFF) and SRI of construction materials, it is recommended to us wastes with water content of 15% or less and carbon content of 20+5% for primary use.

Optimal carbon content to fulfill sintering conditions at travelling-grate sintering machine should be 10-14% if necessary hearth temperature 1100-1200 C0 is provided. Wastes of coal processed with gravity separation at OPP No.1 "Arcelor Mittal" JSC meet

this requirement. Agloporite broken stones of grade 500 and sand of grade 800 can be produced of them.

Ukrainian SRI of coal preparation, SouthGiproStrom and Gas Institute elaborated the technology for processing of flotation wastes and extracting coarse porous sand (light-weight aggregate concrete filler). According to this technology, coarse porous sand is extracted from flotation wastes in fluidized-bed granulator. Those granules are then exposed to the first fluid-bed roasting to burn carbon and the second fluid-bed roasting to agglomerate. The extracted sand is cooled in refrigerator.

Considering scientific researches and experiments mentioned above, project study was made for “ArcelorMittal” JSC on the basis of bench-mark data provided by All-union SRI of construction materials (VNIIStrom). This study was made in form of evaluation of expediency of experimental shop floor construction to recycle coal-preparation wastes, provided that the shop floor productive capacity is high enough to recycle all wastes of OPP No. 1. The same shop floor will also produce the following construction materials: furring tiles of plastic pressing and agloporite aggregates (made of gravitation preparation wastes), coarse porous sand and fuel-bearing additives (made of flotation wastes).

Estimated construction cost of the shop floor is 89.86 mil KZT, profitability level concerning key assets – 21.3%, pay-back period considering current capital – 5.1 year which is shorter than projects with traditional raw materials. The whole value of benefits of construction of coal-preparation wastes recycling shop floor of OPP No.1 is 8.795 KZT per year.

As a result, construction of shop floor which would recycle wastes of OPP #1, and construction of similar factories recycling wastes of Coal Preparation Plants “Saburkhanskaya” and “Vostochnaya” in Central Kazakhstan, including Karagandy and Dzhezkazgan regions, fully supplies their requirements.

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DATA COLLECTION SYSTEM FOR SMART GRID

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To gather data on energy consumption and utilization, a smart grid is being actively developed. It is designed to create a unified automated information and measurement system for reading and controlling energy, heat, and gas metering.

The implementation of such an information and measurement system is a complex process meeting a number of challenges in Russia.

They are as follows:

- A large number of electricity meters;

- A large number of the types of electricity meters;
- Various types of reports of energy savings companies;
- Interaction with existing systems.

We shall consider the system KUMIR-RESOURCE developed by Irkutsk research and development centre KUMIR.

KUMIR-RESOURCE has been developed using free software Ubuntu, Apache, PostgreSQL, PHP, Lazarus and programming languages JavaScript, FreePascal, SQL, PHP. This makes it possible to reduce resource accounting costs and make the system more flexible.

KUMIR-RESOURCE is based on the generic abstract protocol providing measurements of not only heat but water, gas, electricity, and steam consumption as well.

The protocol has been aimed to create a special program layer to translate the generic system instructions into the instructions of meters. The generic protocol makes it possible to read any heat meters remotely.

To send data, it has been developed a special adapter to deal with any type of communication equipment such as GSM modems.

The nucleus of KUMIR-RESOURCE programmed in Free Pascal functions irrespective of the system interface accessible to clients. It improves reliability and safety as it is impossible to affect the operation of the nucleus and distort data. Also, to improve safety, HTTPS is used. It encrypts the data flow between clients and a server.

KUMIR-RESOURCE interface is based on the module technology. It means that each component or menu entry is a separate module automatically connected with the software and printed on the screen. It simplifies and speeds up development of new interface components.

The simulation modeling has shown that KUMIR-RESOURCE is able to serve up to 40,000 meters using one server.

A.A. Belyachenko
A.V. Belyachenko

LONG-TERM AND SEASONAL DYNAMICS OF THE BIRD POPULATION IN "SARATOVSKY" STATE NATURAL RESERVATION

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At present monitoring of specially protected natural areas is of great importance. First of all it is connected with their small acreage in Saratov region. Actually most of the regional specially protected natural reservations are not preserved and research is conducted by different scientists without a unified general program. Moreover, permanent ornithological population observations are essential in Saratov trans-Volga region because of high dynamics of range boundaries for many species as well as habitation of a large

number of rare and protected bird species.

Our research embraces the five-year period (2009-2014). Seasonal and annual dynamics of species number and total bird abundance was studied on the results of monthly relative bird census on the route of 7.5 kilometers in the central part of the “Saratovsky” state natural reservation (SNR “Saratovsky”). The route crossed all the basic bird habitat types represented on the SNR territory: forest plantations, pastures on fallow lands, the Eruslan river valley and the temporary water body in the steppe gully (the third pond). The width of the count area was 100 meters to each side; for large birds of prey (Falconiformes), Gruiformes and Corvidae it was about 500 meters. Along the forest plantations the investigated belt was 35 meters.

The total number of the registered birds amounted to 142 species belonging to 15 orders and 35 families. Among them 12 species are included into the List of endangered species of the Saratov region and the Russian Federation. The largest number of species (89) and the overall abundance of birds (329.6 specimen/km²) are observed during the nesting and post nesting periods (May15 – July1). The smallest number was registered in winter (23 species and 21 specimen/km²).

On the whole the bird population dynamics in the reservation is concerned with several groups of ecological factors: weather and climatic conditions, anthropogenic and natural variability of specific plant associations or their components. Among the weather and climatic factors the mean daily temperatures, dates of the first snow and stable snow cover establishment, intensity and time of snow melting have a significant impact on the species diversity and bird population abundance. As a rule the temperature influences the bird species number indirectly and mostly during spring and autumn migrations which is connected with water bodies freezing in autumn and open water in spring. The first snow falling causes mass birds' flying away that stay too long on the reservation territory till late autumn. Appearance or disappearance of snow cover regulates food supply for many species and is a factor depleting the species diversity early in winter. Anthropogenic factors determining bird population dynamics are different and influence sometimes more than the natural ones. The reserve territory is quite well developed by land users and due to the crop rotations the food supply varies every year. So, the species number being the same the bird abundance increases 2.5 times when sunflower crops are available. It is especially vivid during autumn and winter periods. Artificial regulation of large water bodies, autumn flooding of water basins on the Eruslan River, felling of trees on the water bodies banks and forest plantations as well as land use for pastures can be considered among anthropogenic impacts.

Thus, anthropogenic factors are the key ones in regulating species number and total bird abundance on the territory of the “Saratovsky” state natural reservation and should be taken into consideration while planning nature protection activities in the wildlife refuge.

T.L. Bezrukova

ROLE FUNCTIONS OF RUSSIA IN THE DEVELOPMENT OF ENVIRONMENTAL SPHERE OF THE REPUBLIC OF ABKHAZIA

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The role of the Russian Federation (RF) in formation of the development policy of environmental (recreational) sphere of the Republic of Abkhazia (RA) is defined as follows: as one of the four countries that have recognized Abkhazia as an independent state, the Russian Federation appears a strategic partner in the economic area as a whole; Russian citizens constitute 95.9% of foreign tourists in RA; in investment to development of environmental sphere Russia is the main investor of programs and projects, both at the level of cooperation of the state and private capital sector.

When creating in spring 2010 the embassies of Russia and Abkhazia, the main purpose of their activities was to strengthen mutual contacts. As a result of intergovernmental agreement signing “On the mutual establishment of trade missions” and “On the Promotion and Reciprocal Protection of Investments” in June 2010, sales office of RA and RF was established, which is an important step in establishing institutional mechanism of full cooperation. Trade missions act as legal entities, on behalf of the governments of their countries and in accordance with responsibilities obtained from them in the area of economic and environmental cooperation between the two countries.

An important step for the development of Russian-Abkhaz relations was Abkhaz business forum (Sukhumi, October 2009). As part of the Abkhaz business forum there was signing of a number of bilateral Russian-Abkhaz cooperation documents, which was the beginning of the restoration of recreational areas to attract tourists and further development of tourist exchange between the two countries, establishment of direct contacts between Russian and Abkhaz tourist organizations, facilitation of formalities related to tourism exchange, exchange of information on national legislation, investment proposals in the field of tourism [2]. The directions of investment in the development of environmental areas were defined: construction of new objects of therapeutic resort or facility or treatment centers; rehabilitation and modernization of existing facilities of therapeutic resort or facility or treatment centers; organization and development of support services.

Within the framework of Comprehensive Plan of social and economic development of RA with the help of Russia measures for construction and rehabilitation of infrastructure (roads, sewerage, water supply, housing and communal services, etc.) , socially oriented objects, objects of industry, agriculture and environment were carried out for the total amount of 11 billion rubles.

For today RA is not able to develop the environmental field by itself or by public funds or by private capital. Implementation of the plan of transformation of RA resorts

into resorts of regional level is impossible without the participation of foreign capital, but foreign investment is complicated by a number of political issues, chief among which is the lack of international recognition of the RA as a sovereign state. To date, RA is a state which is recognized only by four states, one of which is Russia.

Exactly Russia supports economic development of Abkhazia, being a strategic partner in the area of improving social and economic situation, being the main investor in the development of ecological (recreational) sphere of the RA, as well as the main buyers of tourist services. Cooperation between Russia and Abkhazia takes place at two levels - at the national level, financial support is made in the form of grants, private investments are made for the construction of therapeutic resort or facility or treatment centers, on the real estate market, in the sale of goods and services, more often on the scale of the activities of small and medium-sized businesses.

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USE OF MODERN COMPUTER TECHNOLOGIES FOR ECOLOGICAL CERTIFICATION OF SPRINGS

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The analysis of the documents regulating ecological certification of springs showed that in the Russian Federation currently there is no the uniform normative document defining its order. It, in turn, complicates data presentation and carrying out monitoring. However nearby the author gave the basic provisions for drawing up the ecological passport of springs considering geological features of the adjacent territory, hydrological, organoleptic and hydrochemical features of a source, and also the characteristic of a piping and its sanitary state, landscape value of a landscape, etc. We carried out the detailed analysis of all indicators defined and recommended for definition at environmental monitoring of springs. On the basis of this analysis the group of the indicators of an ecological state entered in the passport of springs was accepted.

For computer representation of an ecological condition of springs we developed the relational database (D). The basis for a DB we were the object-oriented information model reflecting both springs and their state, and procedures and results of their inspection. To each of 14 objects (spring, geological conditions of an exit of water to a surface, test, sample, research, the report, type of research, research technique, the device, the adaptation, detail, the tool, the software product, the document) in a DB there corresponds the table with unique number of object and its attributes. These researches of springs are presented to a DB in the form of a chain: a spring → test → a sample → research → the report are also reflected in tables of communications. From a concrete spring some samples which break into samples for research on certain techniques with ensuring necessary frequency rate for obtaining the set accuracy of measurements and reliability of researches can be taken. On the basis of a DB GIS allowing to store data, to solve problems of the complex

characteristic of quality of water, to carry out the analysis of ways of receipt of the polluting substances is developed and visually to display a condition of springs. By results of one or several researches one or several reports respectively which are a basis for the characteristic of an ecological condition of system of springs are formed.

Is of interest to make available information on quality of water of springs and the facts of its pollution by microbic and chemical agents for the population of the Saratov region, with use of information stands near springs, and also mass media, including the sites of an ecological orientation (eko64.rf; akv64.ru; reki64.rf, etc.).

Evident submission of this information demands creation of information system in which the site is only the interface for users.

In system information has to be provided in formats of the text, tables, schedules, cards, to audio, a photo and video.

At addition of graphic information in a database, the image remains in the directory which is taken away for storage of information such, and in fields of the table which has to contain graphic information, only the way (a directory of storage and a name of the file with the image) to the added image registers. Such approach allows to increase several times speed of information system, in comparison with approach in which the image directly remains in fields of tables of a database.

N.A. Borisov

PREVENTIVE MEDICINE AS A FACTOR IN THE DEVELOPMENT OF HUMAN CAPITAL ON A REGIONAL LEVEL

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Management in the health sector has been made possible thanks to intensive processes in the area of scientific and technical progress, since the second half of the XVII century. History of Preventive Medicine is associated with the names of the great doctors. Hippocrates, in particular, said that the occurrence of the disease is easier to prevent than to treat disease. Bostreli K. stated that “the most effective medication for physical health is a cheerful and happy mood of the spirit.” Famous doctor early XIX century Mudrov MJ considered the first duty of a doctor monitoring the healthy people for early diagnosis and prevention of diseases.

Preventive medicine is the medicine of the future, as warned GA Zakhar'in, AA Ostroumov NI Pies.

Economists consider health as a part of the human capital. For example, Gary Becker believed that the composition of human capital, along with the skills, knowledge, abilities should include health. Roughly the same treats M. Grossman health capital - as an asset, which allows its holder as long as possible “to use for its intended purpose” of their human capital. Human capital and health capital is sometimes identified. This was allowed only

with the development of medicine and a declaration of a healthy lifestyle (HLS). However, in the era of manual labor and production life expectancy was so short that the need for medical intervention would be expensive and pointless. Shelf life of 15 to 20 years - for the primitive communal system - explained stringent conditions for the existence and survival of the people. High mortality in infancy, despite the lack of contraceptive prevention, led to a reduction in human population. In the feudal period, 40-year-old population was associated with older age. Only in the mid-twentieth century, with extensive results and successes of medicine became possible longevity and population aging. Until now, in some African countries (eg Burundi) there is no problem of pensions, as the period of life of the population is not more than 40-42 years, due to hard physical labor in the agricultural sector, the lack of a full medical and public assistance. From our point of view, health is an important part of human capital, as though a disability does not preclude human possibilities of expression, but restricts them. Healthy lifestyle, its promotion and prevention of ill health - that's the way the growth and strengthening of human capital.

These positions are the most important priority of public policy, both at the federal and regional levels. Program-target method in the management of medicine gradually established himself as a promising and effective under the conditions of different areas. The main objective in its application associated with the state growth rates of fertility and reduce mortality, especially in the regions of Russia. The authors write that "the tragedy of Russia - a high mortality rate of working age: a comparable mortality rate is 3 times higher than in developed countries and in 2 times - in countries with roughly the same level of economic development. Basically, it refers to the male population. "On the basis of this article, it can be concluded that male mortality in Russia is higher mortality among women in the relevant age from 4.9 times in *vozzrastnom*.periode 40-44 years to 3.3 times in the period of 50-54 years.

Not only affects the mortality depopulation of the Russian population. The lack of growth in the birth rate also plays a role. Thus, in 2012-13. in the demographic development of the Kursk, Lipetsk, Voronezh, Tambov regions marked by relatively high natural population decrease with an increase in the birth rate and the death rate is almost unchanged. In the best position in this sense remains Belgorod region, where the natural decline of 2.5%, the worst - Tambov, where the natural decline of 6.4% at the all-Russian exponent of -0.1%.

The main causes of adult mortality are diseases of the circulatory system, neoplasms, injuries and poisonings. The roots of these diseases lie in the changing lifestyle of the population prevalence of bad habits, emerging new tradition of food, increasing the psycho-emotional stress, reduced physical activity.

As a result of routine inspections of school children in the Tambov region, only 20% of students are among the healthy and have one group of health. About 16% are at risk for the development and diseases of the musculoskeletal system, 10% - the disease of the digestive system. Thus, we can conclude that the disease is largely due to lifestyle and behavior of the population.

Existing negative trends in the health status of the population in the regions indicate

the need for targeted prevention efforts to educate the citizens on personal responsibility for their own health, the formation needs to comply with the principles of a healthy lifestyle and conscientious objection to the use of psychoactive substances.

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LAND USE REGRESSION METHOD FOR DESCRIPTION OF POLLUTANTS SURFACE DISTRIBUTION IN SOILS OF URBAN TERRITORIES

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High spatial resolution modeling of fields of surface distributions of impurities in the deponent media is necessary in the studies of mass transfer processes, both in the deponent media, and between deponent media. Furthermore, the fields of distributions of the impurities with high spatial resolution are required for the assessment of individual exposures of residents on the basis of their geographical mobility scenarios for the tasks of environmental medicine. While describing the distribution of impurities in the large industrial areas some significant difficulties associated with contributions of local sources (motor vehicles, industrial areas), road network density and structure of the residential areas, weather data, and other factors occur. For the construction of fields with high spatial resolution of surface impurities on the distributions of heterogeneous urban areas a relatively new approach - the method of Land Use Regression (LUR) - can be used.

The information basis of LUR method is the following: geographic data of the study area, special campaign of measuring of the concentrations of impurities in the deponent media in a certain number of places in the city, and regression analysis to determine the relationship of measured concentrations and derived geographical variables. Various studies use a different source of geographic information, methods for measuring the concentration of impurities, and also features of regression analysis for modeling the distribution of impurities in the deponent media. Because of the significant local features the ways of applying the method are different in each study. Currently LUR method is not standardized and is not designed as a strict algorithm.

The purpose of this study is use of LUR method to describe the distribution of impurities in the soil of a heterogeneous urban area on the example of the neighborhood Vtuzgorodok in Yekaterinburg city, Russian Federation.

The actual location of points was determined during testing directly on the ground, based on the necessity of soil sampling on natural areas in study area. Totally 81 samples near the intersections of significant highways were selected.

Assuming that the main influence on the distribution of impurities in the soil of the study area is done by heavy traffic and the impact of closely spaced industrial zones, it was decided to limit the analysis of the variables describing only these factors. Variety of

variables, as well as the extent to which they have been calculated (from 8 to 1024 meters) made it possible to identify those that have the highest correlation with the level of pollution and build the model of the surface distribution of impurities based on them.

It was proposed to consider the roads as an area emissions source, which enables to avoid pre-categorization and simplify the LUR analysis (in the previous works the roads were considered as line sources with the mandatory division into categories according to the traffic). This assumption was confirmed by statistical analysis for the study area.

The influence of the variables related to the roads on the distribution of the concentrations of titanium, vanadium, chromium, and zirconium is revealed, which may be due to the effect of the secondary surface mass transfer.

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ARTIFICIAL NEURAL NETWORK INTERPOLATION OF GEOCHEMICAL FIELDS OF SURFACE SOIL INSIDE A SMALL AREA

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The models predicting the spread of contaminants in the deponent media (snow cover, soil, bottom sediments) on heterogeneous areas suggest the solution of complex systems of equations describing the dynamics of mass transfer processes. Solving of this problems requires a large amount of input data, most of which can only be obtained by screening of study areas, that reduces to zero advantages of the analytical approach. To solve such problems the method of artificial neural networks (ANN) can be applied.

Objective: to assess the possibility of applying the ANN method to restore surface distribution of the chemical elements in soil inside a small area.

The experimental area 1x1 m² in the Yamal-Nenets Autonomous Okrug (YNAO) was selected away from sources of pollution with a typical natural landscape, without a trace of human impact. 100 samples from the upper soil layer (thickness 0.05 m) inside this area were selected at a regular grid with a step of 0.1 m. Samples were analyzed by X-ray fluorescence spectrometer Innov XX 5000 Olympus.

For the simulation the most common type of ANN - multilayer perceptron with Levenberg-Marquardt learning algorithm was used. At the first stage, the network model for the construction of the distribution of each element contained in the sample was applied. The coordinate vector of samples was fed to the input of the network, the concentrations of the individual elements in these samples were fed to the output. For the primary selection of the ANN structure the correlation coefficients were used.

During the selection of the optimal network from 20 to 50 models were tested in which the number of hidden layers and neurons in them were varied, while the total number of neurons remained unchanged.

The second stage involved the distribution indicators building on the basis of the network, taking into account the influence of the chemical elements on each other. The coordinate vector of the measured samples was fed to the input of the network, the vector of elements concentrations in these samples was fed to the output. Initially the output vector consisted of two components (elements with a maximum correlation coefficient), to which the other components were added step by step in order of decreasing the correlation coefficient. The 16 models of networks differing in the amount of chemical elements in an output vector and the total number of neurons in the hidden layers (50 and 100) were built.

To compare approaches in building ANN the only criterion of network quality - relative standard deviation - was selected.

It is found that for the restoration of the surface distribution of chemical elements in the surface soil of the selected small area (total number of observations - 100) the multilayer perceptron network with the Levenberg-Marquardt learning algorithm has a minimum standard deviation with the following structure: the total number of neurons of the network - 30, the number of hidden layers - 3.

A network with vector output, taking into account the correlation between the elements, with a single presentation shows comparable relative standard deviations with the trained neural network with scalar output, restoring the value of the concentration of a single element. Using ANN with vector coordinate input and vector output, generating geochemical range to restore the distribution of chemical elements in the deponent media seems to be promising.

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DEVELOPMENT OF TECHNOLOGY FOR THERMAL INSULATION OF MICRO- AND NANO-REINFORCED SHELLS BASED ON MINING AND PROCESSING OF WASTE PRODUCTION

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The need for a high-performance thermal insulation materials for underground pipe laying is an important economic tasks. Piping and heat networks are essential elements of district heating systems. Their total length in the Russian Federation is more than 260,000 kilometers,

in Germany more than 120,000 km. For pipe insulation must be replaced annually to 30% of insulation. Currently used pipe insulation, both in Russia and in the EU in most cases does not satisfy the requirements for fire resistance, corrosion resistance and other characteristics.

To eliminate most of the disadvantages is necessary to develop and apply methods to improve operational performance of thermal insulation materials.

The aim is to develop the composition and manufacturing of high-performance materials for thermal insulation of pipelines based on a mixture of thermosetting resins (urea and phenolic oligomers) and mining and processing of waste production (microcalcite, technological dust rocks with ESPs).

During the study were obtained several types of thermal insulation materials with different density, thermal conductivity and compressive strength.

Materials based on these compositions are gas-filled moldings with a closed meshed structure. They were obtained by pouring into open or closed form, both in the laboratory and in industrial environments. Upon receipt composites mixture of the reactants in a short time passes from a liquid to a gel state and is foamed, followed by curing the resulting foam. Foaming is accompanied by the release of large amounts of energy due to the exothermic reaction components. Filled composites with more than 22% leads to the formation closed cell structure of the material, which has a positive effect on the performance characteristics of the material (improved thermal conductivity).

The average cost of the resulting composite - 70 euros. Marketing analysis showed that the developed insulation material easy to take significant market share of thermal insulation materials (about 7% of the Russian Federation, and 4% in the EU), in particular for use in the construction of new and renovation of existing heating systems and insulation of pipes for various purposes. This price will provide the necessary level of profitability of the organization, enabling it to maintain a good financial situation and solvency

V.A. Burkovskaya

ECOLOGICAL FACTORS OF MODERN MIGRATION PROCESSES

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The distinctive feature of modern society is the increase of mobility and activation of migration processes. The character of migration can be different: permanent (related to resettlement), temporary (episodic), seasonal and pendular. The reasons making the people move are quite a lot to single out: social and economic instability (the changes on the labour market, unemployment including professional, the absence of opportunities

to get education, etc.), conflicts between nations, persecution of different kinds, civil wars, growing urbanization, repatriation as well as subjective and personal grounds.

At present one could state the growth of ecological factors of migration processes in the developed information-technical society. Conventionally they are to be classified in the following way:

- natural factors of migration: earthquakes, floods, tidal waves, volcanic eruptions that force the people into changing their places of settlement representing the zone of elemental disaster; to these factors one may also add geographical, natural and climatic zones characterized by extreme conditions for permanent living;
- technogenic environmental factors of migration: accidents at nuclear power stations, emission of poisonous substances, chemical and radioactive pollution of the air, soil and water, not keeping to the sanitarian norms of utilization of wastes from the productions that are harmful to life and health, etc.;
- ethno-ecological factors of migration: spreading of different kinds of diseases on certain areas, epidemics, geo-chemical features of the environment provoking pathological processes; the presence of microorganisms characteristic of the region and dangerous for man; exhausting of natural resources to secure life, a reduced level of physiological adaptation to the ecosystem causing neurotic and psychic disturbances, endocrine, heart and capillary diseases, regression of reproductive functions, etc.;
- ecological hygienic factors of migration: a low level of ecological and household culture on the territory, the absence of infrastructure and insufficient development of public utilities provided; violation of the sanitarian and hygienic norms while constructing dwelling-houses, educational and health institutions as well as reusing the objects which used to serve for harmful productions; the presence of allergens in highly concentrated quantities;
- environmental legal factors of migration: violation of environmental legal public relations, the absence or insufficient development of regional environmental legal basis, not yet fully developed environmental legal protection of the population, failure to use the regulating norms in the sphere of economic relations to a full degree.

Thus, ecological factors are able to exert a considerable influence on the activation and development of contemporary migration processes. The quality of man's life should not be limited only to the blessings of the civilization, not less important is such a constituent as observation of man's rights to the clean environment and the safety of living space.

V.D. Burkovsky

THE DEVELOPMENT OF ECOLOGICAL CONSCIOUSNESS OF THE STUDENTS IN THE PROCESS OF DELIVERING THE COURSE OF INSTRUCTION IN BASICS OF LIFE SAFETY

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The modern ecological state of our planet dictates an urgent necessity of transforming the system of views on the environment, of a global change of consciousness, reorientation of the outlook of the young learners. A low level of ecological culture, lack of social responsibility for the processes and results of interfering in the sphere of nature, a selfish attitude to important life-sustaining resources bring about actualization of the issue related to the ways of ecologizing education.

The course of instruction in Basics of Life Safety, covering the problems of theory and practice of man's protection from dangerous and harmful factors of natural, technogenic and social character, contains quite a complete informative material on the prevention of ecological catastrophes and withstanding a global ecological crisis, which is supposed to develop ecological consciousness of the students.

Four directions are singled out to mould ecological consciousness:

- scientific: storing and classifying the knowledge of nature, its laws, methods of cognition of the surrounding world, etc.;
- economic: admitting economic profits gained by the rational use of natural resources;
- cultural: perceiving nature as an inseparable part of the social and cultural environment, desire to transform the surrounding world, restoring and replenishing its wealth, understanding of the ethic values of conservation activities;
- political and legal: understanding of the necessity of ecological policy, creating conditions in the society to carry out ecological programmes, develop ecological movements, mould the public opinion and getting aware of the importance of ecological law.

Thus, ecological consciousness incorporates the whole set of views, motivations, relations, etc., which reflect rational, emotional, sensual and behavioural components.

Ecological consciousness is unproductive without ecological activities directed at an adequate estimate of the state of natural resources, the creation and realization of the strategies for establishing dynamic balance between man and nature, at the use of norm-stimulating measures in relation to conservation activities as well as the use of values and principles necessary for the development of culture.

The course of instruction in Basics of Life Safety at a higher educational institution is aimed not only at the acquisition of theoretical knowledge but also at the development of skills and habits of self-protection and protection of the people around in extraordinary

situations, at the prevention of extreme cases and opposition to violations in the use of natural resources and conservation activity, etc.

The present course contributes to the development of the following competences: the ability to take measures for preservation and protection of the ecosystem in the course of social and professional activities; the knowledge of methods of protection of the population against possible consequences of accidents, catastrophes, the elements; motivation to perform professional activities in non-standard (extraordinary) situations. The given competences are to be organically combined with the development of ecological consciousness

A.G. Chuvilin

ENVIRONMENTAL IMPACTS OF A WASTE LANDFILL IN THE OSSORA SETTLEMENT (NORTH-EAST KAMCHATKA)

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Today, the development of the world industry has reached such a scale that if the issues of environmental protection from anthropogenic impacts are not paid very careful attention to, the world may find itself on the verge of an environmental disaster. For example, only in the Kamchatka Krai, the biosphere is polluted by tons of hazardous waste every year, which causes a great damage to the environment.

There are 6 waste landfills on the territory of the Karaginsky municipal district, necessary environmental and sanitary requirements not being met at any of them. At best, we are talking about authorized landfills (Ossora settlement, Karaga village), but mainly, next to remote, tiny settlements, there are non-authorized spontaneous waste clusters not only of the domestic, but also of the industrial origin, the amount of which does not go down. From the total amount of the generated waste, merely 1% is treated at a manufacturing facility, a third is stored on its territory for the purpose of waste utilization and more than a half is dissolved in the environment.

The landfill near the Ossora settlement is situated in the immediate vicinity of the area of groundwater discharge of the water-bearing section by means of water migration to coastal-marine and lagoon deposits.

The movement of the groundwater in the water-bearing section has a fissure-stratal character and is normally directed to the Ossora bay.

In the period between August and September 2012 we conducted a laboratory research of the soil cover condition at the waste landfill. The soil was examined in terms of 8 parameters: zinc, copper, cadmium, lead, mercury, oil products, nitrogen nitrate and labile phosphorus.

Since August 2012 we have been monitoring the surface water condition of the Ossora bay in order to determine the technological impact on the environmental pollution. The

sea water samples are taken quarterly at specified monitoring points. The surface water condition of water bodies in the proximity of the waste landfill has also been researched in the laboratory. Up to now, more than 40 samples have been tested.

The conducted research revealed that the soil cover of the waste landfill in the Ossora settlement was heavily polluted by phosphorus – between 3 and 4 MAC (MAC of phosphorus being 27.2, samples between 73 and 101 MAC) and by oil products – between 3 and 75 MAC (baseline sample – 7, samples between 20 and 530).

The chemical pollution level of the soil cover in the given region makes it possible to characterise the level of soil contamination as moderately dangerous and the category of soil contamination as average.

In the researched water bodies, there are processes of anthropogenic eutrophication indicated by high BOD5 levels of easily oxidised organic compounds (the characteristic value for the Bering Sea is between 0.5 and 5, samples show values between 175 in the lake next to the waste landfill and 38 in the Ossora bay), phosphate ions up to 9 MAC in the sea water and up to 94 MAC in the fresh water (MAC is 0.2, samples between 18.8 and 0.6). According to the biochemical oxygen demand, the water is characterised as heavily polluted.

A chemical substance that clearly proves the decay process in water is the ammonium ion. The increased MAC levels (2.9) reach 85 in the fresh water and 4 in the sea water.

Water bodies are also contaminated by chlorides, suspended matter, iron and oil products.

As a result of our research we were able to determine that the impact of the waste landfill of the Ossora settlement is real and can lead to serious environmental consequences.

In order to improve the environment in the Ossora settlement, it is necessary to create a new solid waste landfill that would meet all the requirements of current environmental regulations.

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IMPROVING THE ENVIRONMENTAL PERFORMANCE OF GAS TURBINE ENGINES BY USING METHODS OF MULTI- CRITERIA OPTIMIZATION

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One of the main directions of gas turbine engines (GTE) development is to improve its environmental performance: reducing the emission of pollutants and level noise. Reduction of pollutant emissions can be achieved by improving of GTE thermodynamic cycle parameters. GTE thermodynamic cycle parameters can be improved by increasing the efficiency of GTE main units, such as the compressor. Modern CFD-modeling software such as NUMECA FineTurbo can accelerate the compressors development and

improving its efficiency and allows to use optimization methods that implemented in the software package IOSO.

The results of a seven-stage high-pressure compressor (HPC) optimization are presented in this paper. The optimization task was to improve the HPC efficiency at two operation modes (100% and 80% rotation frequencies) by optimizing of the stagger angles of all blade rows. The total number of optimization's variables was 15 (setting angle of 7 rotor blades + 7 stator blades + inlet guide vane).

The HPC mathematical model was created using NUMECA FineTurbo software. The model included domains of all HPC blade rows and bearing which is located before compressor. Validation of the numerical model was carried out before starting the optimization process by comparison of calculated and experimental characteristics.

IOSO software needed 446 references to HPC numerical model to solve the optimization task. One reference to numerical model consisted of calculation of two points at the HPC performance map in the programming software NUMECA FineTurbo: max efficiency points at the 100% and 80% rotation frequencies.

Set of unimprovable solutions called Pareto set was obtained as a result of solving optimization task. Pareto set was a compromise between efficiency increase at the 100% and 80% rotation frequencies. Each point from Pareto set had a correspondence with HPC geometry represented as angles massive of all HPC blade rows.

The middle point of Pareto set (point 3) was chosen for further investigation. This point allowed to achieve efficiency increase by 0,5% at the 100% rotation frequency and by 1,6% at the 80% rotation frequency.

Flow structure analysis of optimized HPC showed that optimization of stagger angles allowed to eliminate flow separation near hub of 4th and 5th HPC rotor.

The conducted investigation showed the opportunity of the optimization methods using for engineering development of the multistage HPC and improving GTE environmental performance.

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EXPERIENCE AND PERSPECTIVES OF SPECIALISTS TRAINING AND PROFESSIONAL DEVELOPMENT IN ENERGY SAVING AND ENERGY EFFICIENCY ON THE REGIONAL AND MUNICIPAL LEVELS

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A system of education in the field of energy saving and raising energy efficiency has been developed, built and successfully used for a number of years in the Ural region (the centre is Ekaterinburg). In 1999 in the Ural state technical university-UPI (nowadays – Ural Federal University) «Energy saving» department.

At the present time more than 2000 senior students listen to the lectures and study the energy saving and energy efficiency raising issues at the practical studies yearly at the «Energy saving» department. During these years more than 25000 senior students of ten institutes (faculties) and a number of the UrFU territorial branches have received training, this list continues to enlarge.

In the system of preparing and certifying specialists there have been trained and certified more than 8000 employees of the budget sphere, industrial enterprises, agriculture, building complex, housing and utility sector, defense and law enforcement agencies, municipal officers. The experience of this work has been presented in a resource book issued with the support of Ural Energy Service Company, Ural Interregional High Voltage Grid Company and Self-regulating organization – Noncommercial partnership «Union «Energy efficiency».

One should also point out the unique long-term experience of organizing and conducting all-Russian students' academic olympics on disciplines «Energy– and resource saving», «Unconventional and renewable power sources», scientific-practical conferences with international participation, exhibitions of scientific-technical creative work of students, post-graduates and young scientists «Energy and resource saving. Energy supply. Unconventional and renewable power sources». Since 2000 more than 4500 people from several dozens of Russia's higher educational establishments have taken part in these youth events, organized by UrFU, 14 collections of students and post-graduates' works in this sphere have been published.

Scientific-methodological approaches to forming fuel-energetic balance of the region have been worked through, main principles of economic activity energy analysis have been based, methodological recommendations for developing regional energy saving programmes have been worked out at the department.

Since 2012 the department has been taking part in realizing President's programme for professional development of engineering staff planned for 2012-2014, having won in the contest held by the RF Ministry of education and science in the programme «Energy saving, raising energy efficiency and resource saving in industry». In 2012 40 specialists of industrial enterprises and specialized organisations of Ural Federal District completed training following this programme. In 2013 50 specialists of a number of enterprises and organisations of Sverdlovsk and Chelyabinsk regions were taught. In 2014 this work is going on. This activity is planned to be carried on the regional and municipal levels.

The programme is realized in a module format. The course is divided into modules, three of which are theoretical in their nature and the longest one is practical. Participants of the course are taught how to organize a system of energy management ISO 50001 at an enterprise and its certifying according to international requirements.

Systems of dispatching, monitoring, automated systems of control and energy resources consumption records of different level at industrial enterprises, in residential sector and other large facilities are studied. Issues of decreasing energy losses in buildings, transition to «energy passive house-building» are considered. The questions of renewable energetics,

SmartGrid systems, modern principles of thermal and electric energy generating, energy saving in gas transporting are disclosed.

The potential of teaching staff and specialists of Ural Energy Institute of UrFU allows to cover all the indicated questions specifically. The customers of training are mainly large industrial enterprises with a considerable volume of fuel and energy resources consumption.

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THE TECHNOLOGY OF REMOVING OIL FROM THE SURFACE OF THE FLOWING WATER BY USING A STAND-ALONE DEVICE

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Currently intense development of technologies for water purification from oil and oil films has been observed. There are several main methods for cleaning surface water from oil and oil films. Each of these methods - chemical, mechanical, physical - has its advantages and disadvantages. However, the use of known technologies in the context of flowing waters ineffective.

An important condition for the operation of clean water from oil pollution is their autonomy and the use of environmentally friendly energy sources. To improve the efficiency and productivity of the collection, containment and removal of oil spills and oil from the surface of watercourses by the authors for this purpose we have developed a new technology and installation. The peculiarity of the technology is the use of the energy of the water flow and the modular design of the facility.

A device has been developed to remove oil from the surface of the flowing reservoir includes a floating platform, a partially submerged oil storage drum, with the working surface moving relative to the surface being cleaned water and pinch rollers forming at the contact surfaces of the oil storage drum gutters to collect oil, made with the possibility of supply of collected oil in storage tanks. The unit is equipped with turbine running on the energy of the water flow and providing through the gear moving surface skimmer drum relative to the cleaning surface of the water, and float the platform is equipped with a locking and/or floating anchor. Technology for cleaning the surface of the water flowing from the oil reservoir or the oil film is based on the effect of absorbing oil and petroleum products of hydrophobic material. During the rotation of the drum partially submerged in contaminated oil or petroleum products water, the hydrophobic surface of the drum, repels water and absorbs oil, which is then pressed by the rollers. A float platform can be made in the form of a catamaran, with the necessary number of buildings connected by a bridge, and gathering drum is located in the space between the hulls. Between oil

containment booms a filter can be installed as a grid-conveyor ensuring removal of the waste from the water within the working area. In the process of collection and removal of oil containment enclosure and a device with a rotating drum work or at rest, or moves downstream with a velocity less than the velocity of flow of water. For rotation of the drum and transportation of oil in storage tanks is used, the energy of the water flow. After lling-drive, removal of accumulated oil or replacement of a capacity flash drive takes place.

When a significant width of the flowing contaminated water body use multiple devices for removal of oil, connected by a chain through the boom. To prevent the ingress of debris into the skimmer dryer and garbage disposal, use grid-conveyors and conveyors. Grid-conveyors and the conveyors are driven by the energy of the water flow is pumped through the turbine or impeller. The waste separated from the water is collected in a disposal container.

The efficiency of the developed technology increases with the rate of flow of water. The comparison of existing technologies with the one developed by the authors showed that the efficiency of collecting oil from the surface has increased in 3-5 times, and the purification of water in 2-3 times. Tests also showed that with the help of a conveyor, the developed device can be used for cleaning of water bodies with stagnant water, for example, wetlands.

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A.Y. Rybkin

THE IMPACT OF TANK FARMS ON THE ENVIRONMENT IN THE REPUBLIC OF SAKHA YAKUTIA

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The organic pollutants content in the environment of oil tank farms in Sakha Yakutia has been evaluated fully by authors for the first time. The main natural environments such as air, soil and snow covering were investigated.

Modern physical-chemical methods: gas chromatography-mass spectrometry, photometry, spectroscopy, high performance liquid chromatography, have been used for the identification of organic pollutants.

More than 500 samples were taken and analyzed. Ecological field study, including several stages, was conducted in 2010-2014. This is allowed to consider seasonal characteristics of equipment handling, affecting the composition and the level of anthropogenic emissions into the environment.

We have identified more than 60 types of organic compounds in the air of the test space, the total percentage of identification was 92%. It is shown that the method of air sampling and analytical sample preparation affects the qualitative and quantitative composition of the detected organic pollutants. The most comprehensive information

was obtained by sorption sampling method as well the thermal desorption and extractive methods of samples preparation.

We have studied the qualitative and quantitative analysis of soil contaminants industrial zone of tank farms. Identified a number of benzene, aromatic hydrocarbons (toluene, xylene, etc..) polyaromatic hydrocarbons (naphthalene, anthracene, phenanthrene, fluoranthene, pyrene, chrysene, fluorene, benzpyrene, and their alkyl derivatives); oxygenderivatives (dibenzofuran and its alkyl derivatives), sulfurderivatives (dibenzothiophene et al.), alkanes (C17-C27). We have found a high content of oil depots in the soil of polycyclic aromatic hydrocarbons.

Snow covering is a sensitive pollution indicator of the low atmosphere layer. Its chemical composition reflects the distribution of pollutants in the environment during the winter period. We performed a qualitative and quantitative analysis of the content organic pollutants in snow covering in industrial area of tank farms. The total concentration of detected organic pollutants was 400 mg / m².

The results of survey allowed us to give environmental, medical and social characteristics of tank farms in the Republic of Sakha Yakutia, to develop the range of improving measures for the working and the natural environment as well to organize the analytical organic pollutants - monitoring in the environment of industrial areas of tank farms.

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S.V. Gunich
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THE DISPOSAL OF UNSORTED MUNICIPAL SOLID WASTE BY THE METOD OF MICROWAVE THERMOLYSIS

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Special attention of researchers is paid nowadays to the generation of effective methods and technologies for disposal of municipal solid waste (SW). One of the most promising process is the pyrolysis.

We have found that the application of electromagnetic radiation of ultra-high frequency 2.5 GHz with the process temperature of 600-900°C without air provides increases the heat transfer by 40-60% in comparison with the process without activation. Fuel costs are reduced to 70%. The advantage of microwave heating is the fact, that the theoretical conversion efficiency is close to 100%. At the same time the power consumption was decreased, working and environmental conditions were improved.

The technological plan and instrumentation of SW disposal process were developed. The technology meets all up-to-date requirements. Purification of flue gases allows to neutralize combustion products from the highly toxic organochlorine pollutants, nitrogen oxides, sulfur and carbon. The pilot reactor was created by authors of the article, its industrial testing in technologies of waste disposal (Tambov) was carried out.

It is shown that the obtaining of carbon residual is possible as a result of microwave thermolysis of unsorted solid waste. The elemental composition, the metals and halogens content in the carbon residual are similar their composition and contents in some sorts of coal, that has heat value of 25 - 28 MJ / kg. It is found that the obtained carbon residual, being a cheap commercial product of waste disposal, can be used as a raw material in the fuel and energy industry.

O.A. Drozdovskaya

**MICROBIOLOGICAL ASSESSMENT OF CONTAMINATION
BY PHENOL IN THE COSTAL WATERS OF THE PETER
THE GREAT BAY (SEA OF JAPAN)**

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Coastal sea waters are contaminated by phenols almost throughout all the urban territories. The main sources of pollution by phenolic compounds are wood processing industries: plywood, pulp and paper plants and others. Furthermore, phenols can reflect water contamination by organochlorine pesticides, oil products and can also be of faecal origin. In this regard, the development of effective techniques of timely operative control over the coastal water environment is becoming more and more critical.

Microbial indication is one of the most sensitive and operating methods of sea water monitoring. It can in no way compete with methods of the chemical analysis, however, it supplements them, allowing for a quick assessment of the contamination level of coastal waters without any extra costs.

In our research, we studied the structure and properties of planktonic microbial communities in the heads of bay of the Peter the Great Bay (Amur, Ussuri, Vostok, Nakhodka Bays) as well as in its south-western part. The most suitable parameter for the microbial indication of the contamination by phenols turned out to be the number of phenol-resistant planktonic microorganisms.

The results of the microbial indication showed that the water area covered by the Peter the Great Bay is contaminated by phenols to a significant extent. The number of phenol-resistant microorganisms in different parts of the bay varied between 101 to 104 CFU/ml. The dominant factors of the contamination by phenols were different in all cases.

The Peter the Great Bay is a zone of active navigation, that is why potential predecessors of phenolic compounds seem to be oil products, whose decomposition leads to an increase in the pollutant amount in the sea water.

The south-western part of the bay, including the water area of the only state marine nature reserve in Russia, is influenced by the Tumen river which flows on the territory of the industrially developed regions of North Korea and China and carries millions of cubic meters of untreated waste water. Along the whole estuary, there are phenol-resistant microorganisms, which can be a consequence of faecal sterols in water or contamination by pesticides.

Phenol-resistant microorganisms were also found in the Vostok Bay that served as a baseline section during the monitoring, which can be a consequence of both the indirect (oil) and direct influence (faecal sterols, pesticides, photogenic phenols).

The comparative analysis of the number of phenol-resistant microorganisms made it possible to mark out zones with an increased content of the pollutant. These zones were mainly connected with the areas of active anthropogenic activity, e.g. water areas of the Amur and Ussuri Bays, shore waters of Vladivostok and the Nakhodka Bay with the town of Nakhodka, one of the largest and fast developing ports in the Far East, in which an oil-loading terminal was put in commission in 2009. In these waters, the quantity rate of phenol-resisting bacteria reached the highest values.

Based on the chemical data in the area of phenol and microbial indices content, we established a direct correlation between the number of phenol-resisting microorganisms and the intensity of contamination by phenols in the marine environment. The highest indices of phenol-resisting microflora were registered in the regions in which the phenol content exceeded the maximum allowable concentration for phenols by several orders. This way we have proof confirming the reality of an individual microbial response to the contamination by phenols.

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LUMINESCENCE METHODS IN ENVIRONMENTAL MONITORING OF ECOTOXICANTS

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Among the organic compounds that determine the ecological state of the environment, one of the first places is occupied by polycyclic aromatic hydrocarbons (PAHs). The content of these substances in the environment requires constant monitoring. In this regard, the development of simple, expressways and available methods for the determination of PAHs in the environment is relevant. Now, it is known a number of physical and chemical methods for the determination of PAHs. The most widely used method for the determination of PAHs is based on the application of Shpol'sky effect. Analysis needs the complex sample preparation and high-resolution spectral measurements at a temperature of liquid nitrogen (77K).

During the transition from low temperature to room temperature (20-27°C) luminescence quantum yield decreases sharply as a result of increasing of the rate of nonradiative processes. The intensity of these processes can be reduced using aqueous micellar solutions of surfactants as a medium for monitoring the PAH luminescence. Another approach, which allows to move away from the use of low temperatures is associated with the use of solid matrices, in which PAH are introduced. In this case fluorescence and phosphorescence of PAH adsorbed on solid substrate is used as the analytic signal.

It is founded that the presence of heavy metal ions can increase the intensity of the

room temperature phosphorescence (RTP) of PAHs and lower limits of detection. Using a variety of heavy metals, capable of varying degrees of influence on the intensity and lifetime of phosphorescence phosphors, in some cases allows selective determination of PAH without prior separation of the mixture components.

For the experiments it was chosen representative of the class of PAHs - pyrene (manufactured by «Fluka»). It has a large luminescence intensity and is the least toxic PAHs. We used lead acetate as a heavy metal. Solid matrix - filter paper brand "Red Ribbon" served as cellulose matrix. The luminescence spectra were recorded on a fluorescent spectrometer LS 55 (Perkin Elmer). Spectra of fast fluorescence and phosphorescence pyrene at room temperature were obtained at stationary photoirradiation of the samples of cellulose matrix modified by lead acetate with sorbed pyrene.

The detection limits of pyrene by fluorescence method is $9 \cdot 10^{-8}$ M, by phosphorescent - $3 \cdot 10^{-8}$ M. Fields of linear dependence of the calibration graphs for the fluorescence method were from the concentration of pyrene $2 \cdot 10^{-7}$ to 10^{-5} M for phosphorescent – from $5 \cdot 10^{-8}$ to $8 \cdot 10^{-6}$ M. In order to increase the selectivity of determination of PAHs in the solid matrix and the exclusion of the background signal we used the phenomenon of transfer of energy of electronic excitation of molecules. For the process of triplet-triplet energy transfer electronic photoexcitation was chosen the system: the donor of energy - acridine dye (tryptaflavine) and acceptor - pyrene. As a result of energy transfer, we observed a decrease in the intensity of delayed fluorescence of tryptaflavine with increasing concentration of pyrene in the cellulose matrix.

The detection limit of this method for pyrene is $4 \cdot 10^{-7}$ M, which is lower than the above-described fluorescent methods. However, the selectivity factor in the determination of pyrene in a mixture with anthracene increased significantly and amounted to 14 ± 1 . This is significantly higher than the selectivity factor for fluorescent (<0.6) and phosphorescent (3 ± 1) methods.

The work results are obtained during completing of the state order of Russian Ministry of Education and Science No. 4.1299.2014/K.

S.E. Egorova
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RADON EMANATION CHARACTERISTICS IN CENTRAL YAKUTIA

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The effect of radon gas on human beings in conditions of Yakutia probed a little because of the almost total absence of reliable data on the contents of radon in homes.

For the measurement of the volumetric content of radon in Central Yakutia devices were used AlphaGUARD by Genitron Instruments GmbH, Germany and Radiometer of

radon RRA-01M-03 firm “NTM-protection“, Moscow, Russia. Radiometer RRA-01M-03 allows you to measure the volumetric content of radon in the air flow of radon from the soil, and radon content in water. The device has a maximum sensitivity AlphaGUARD compared to all the other devices, and refers to the arbitration of the class. On this device carry out calibration and verification of all other measures of radon.

Measured content volume activity of radon in the nine-floor stone building (student residence No. 6B) and the one-story wooden building near Yakutsk, also studied the emanations from the sample of stones collected in the Èl’konskij uranium-ore field in the Aldan region of Yakutia.

In block houses, the maximum volume of radon concentration is found on the first floor: $R_n = 19 \pm 7 \text{ Bq/m}^3$, and the minimum in the ninth floor: $R_n = 4 \pm 3 \text{ Bq/m}^3$. The maximum allowable concentration (MAC) of radon in indoor air is 100 Bq/m^3 . This means that the maximum value of the dorm 6B in 5 times is less than the maximum allowable concentration.

Beside the wooden house near Yakutsk there is a basement for storage of meat. The contents of volume activity of radon was $497 \pm 89 \text{ Bq/m}^3$, 5 times the maximum allowable concentration. Also inside the wooden house there is underground, in which maximum result made $312 \pm 62 \text{ Bq/m}^3$. It is 3 times larger the maximum allowable concentration.

Volumetric content of radon-222 in the air were measured by radiometer of radon RRA-01M-03, working on the basis of electrostatic deposition ionized child products of radon in the measuring Chamber to the surface of a semiconductor detector and the subsequent registration of α -radiation RaA (^{218}Po).

Study of emanation from the sample used stones AlphaGUARD. The stones and the device had been placed in a tight measuring Chamber, each dimension ran for 2 hours. The maximum value was found in sample No.2-5/3 - 122 Bq/m^3 , and the minimum is 6 Bq/m^3 in samples No.2-4/2. A new method of estimation of radiation quality of building materials for the emanation of radon inside tight measuring Chamber and comparison of equilibrium concentrations of radon with MAC in indoor air. Radon concentration of sample No.2-5/3 exceeded the MAC, so patently clear that these stones cannot be used as materials for premises, but if their specific effective activity of potassium-40, radium-226 and thorium-232 will be less MAC in 740 Bq/kg , then perhaps their application in road construction work in settlements. Test No.2-4/2 with minimal content of volume concentration of radon 6 Bq/m^3 is suitable for civil and road construction.

In the nine-floor building with maximum contents of volume concentration of radon in the ninth floor person receives an effective dose 0.19 mSv/year , which does not exceed the limit of 1 mSv/year .

In the basement for storage of meat at the volumetric concentration of radon $497 \pm 89 \text{ Bq/m}^3$, the effective dose equal to 4.97 mSv/year . This is 5 times higher than the limit. Therefore, it is not recommended to stay a long time in this area.

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PERSPECTIVES OF WASTE RECLAMATION AFTER GEOLOGICAL EXPLORATION OF URANIUM IN SOUTHERN YAKUTIA

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During geological exploration works in the Elkonsk uranium ore deposits in the Aldan District of the Sakha Republic (Yakutia), people extracted rock formations and ore, creating spoil dumps with high radiation background.

In the course of the field works, we carried out dosimeter measurements using radiation dosimeters of the type DBG-01H. First, we took 10 measurements in every point at the height of 1m above the examined surface and then calculated the mean value and standard deviation of the exposure dose rate.

In the laboratory of Radiation Biology, the rock formation and ore samples were analysed using the gamma-ray spectrometric method by means of a laboratory gamma-ray spectrometer by Canberra Packard, USA, with two semiconductor detectors of a high purity germanium and a thin beryllium window. Due to the cryostats filled with liquid nitrogen with the volume of up to 30l, the detectors are kept cool to an extremely low temperature (-195°C) during the measurements.

In the spoil dumps, we measured the effective specific activity of naturally occurring radionuclides, which equals to the sum of the suspended specific activities of ^{40}K , ^{226}Ra and ^{232}Th . The weighting coefficients in the sum are the ratio of the dose factors to the dose factor of ^{226}Ra :

$$AE_{\text{eff}} = A_{\text{Ra}} + 1,31A_{\text{Th}} + 0,085A_{\text{K}}$$

The main monitoring method of naturally occurring radionuclides in building materials is the determination of the specific concentration of radionuclides by means of gamma-ray spectrometry. The population's exposure to radiation caused by naturally occurring radionuclides in the building materials is regulated by means of limits in the use of the building materials, depending on the effective specific activity of naturally occurring radionuclides.

In order to determine limit classes for the content of naturally occurring radionuclides in the building materials, we took rock formation samples in the mine spoil dumps No.2 and No.3 of the Elkonsk uranium ore deposits. The measurements of the specific activity of the rock formations showed that in 4 sampling points of the mine spoil dump No.2 the activity varied between 477.608 and 627.2102 Bq/kg and corresponded to Class 2, in 2 points between 814.0511 and 993.7102 Bq/kg and corresponded to Class 3, and in 6 points between 1878.222 and 79298.77 and corresponded to Class 4. Other sampling points in the mine spoil dumps No.2 and No.3 exceed the norms of the effective specific activity of building materials and can be used as uranium ore material.

This way, the waste left after the geological exploration of the Elkonsk uranium ore

deposits can be reclaimed as road construction materials within town and settlement limits, future building areas and industrial facilities.

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SCIENTIFIC FOUNDATION FOR THE CREATION OF A RADIOECOLOGICAL MONITORING BASE UNDER CONDITIONS OF A URANIUM ORE DEPOSIT

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The Earth's depths and surface contain a large amount of radioactive substances, potential irradiation sources. In the course of geological exploration works in the Elkonsk uranium ore deposits in the Aldan District of the Sakha Republic (Yakutia), people extracted rock formations and ore, creating spoil dumps with high radiation background.

A scientific foundation of environmental protection measures and preparation of suggestions for the creation of a radioecological monitoring base is a study of laws of radionuclidic migration and distribution of radionuclides in the system "soil-plants-animals-people". This calls for the necessity of a scientific development and practical realisation of the methods and ways which will guarantee the evaluation of the impact caused by radioactive contaminations in the soil and vegetation cover.

We studied mine spoil dumps of the uranium ore deposit, moss, lichen, soil and water from the rivers Kurung and the stream Bezymianny by the foot of the spoil dump 7, mine No.2.

In order to determine limit classes for the content of naturally occurring radionuclides in the building materials, we took rock formation samples. The measurements of the specific activity of the rock formations showed that in 4 sampling points of the mine spoil dump No.2 the activity varied between 477.608 and 627.2102 Bq/kg and corresponded to Class 2, in 2 points between 814.0511 and 993.7102 Bq/kg and corresponded to Class 3, and in 6 points between 1878.222 and 79298.77 and corresponded to Class 4.

The uranium transport by natural waters is mainly connected to the complex formation of the uranyl ion with hydrogen carbonate sulphate ions, the concentration of which increases by 2.1 and 5.3, respectively. Apart from this, its considerable amount migrates in the sorbed state in thin mechanical suspensions and colloids. This is confirmed by an extremely high content of U-238 and U-235 in the moss sample of *Ptilidium Ciliare*, taken in the stream Bezymianny at the foot of the spoil dump 7, mine 2.

Moss has the following magnification scales of natural technogenic radionuclides: that of thorium-232 – 2.8 times, uranium-238 – an absolute increase by 135208 Bq/kg, radium – 90 times, uranium-235 – an absolute increase by 4848 Bq/kg.

This way, there is direct evidence of an active draining of spoil dumps by ground waters

which wash out uranium-containing dust and its water-soluble compounds in a mechanical and chemical way.

The soil sample was taken from the area 50x50cm at the depth of 0-5cm and 5-8cm. The results of the analysis showed that the content of U-238 and U-235 radionuclides was 4-5 times larger in the upper soil layer than that in the lower soil layer, whereas the content of Th-232 and Ra-226 was similar in both layers. This shows that fine-dispersed uranium minerals travel by air and surface water to a considerable distance.

We examined birch, larch, fir and alder samples. The exposure dose rate in this spoil dump reaches 724 $\mu\text{R/hr}$. The specific activity of U-238 in the spoil dump is 21377 Bq/kg, that of Ra-226 - 20444; Bi-214 – 10900 and that of U-235 – 463, respectively.

The fir needle contains 2.6 times more U-235 than its trunk or branches, 2 times more U-238 and 1.6 times more Ra-226. The alder shows the opposite result, the content of uranium radionuclides in the leaves is smaller than that in the trunk and branches: 18.9 times less U-235, 32.6 times less U-238 and 37.6 times less Ra-226.

This way, species of wood are objects for the effective control over the uranium migration and its daughter products in the proximity of uranium-containing spoil dumps. The results of the experiment mean that conifers are better suited for this purpose than leaf-bearing trees.

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ACCUMULATION OF HEAVY METALS IN HIGHER AQUATIC PLANTS

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The Volgograd Reservoir ecosystem is the last link in the Volga River cascade. For the half-century of its existence, it has accumulated plenty of materials of both natural and anthropogenic origin that are hard to mineralize. Higher aquatic plants are most common in the shallow waters of such reservoirs with slow water exchange. Their ability to accumulate substances in concentrations higher than baseline values makes the prospect of their use in environmental monitoring.

The goal of our study was finding the major patterns of heavy metal accumulation in higher aquatic plants, widespread in shallow waters of the Volgograd Reservoir and belonging to various ecological groups: *Butomus umbellatus* L., *Typha angustifolia* L., *Potamogeton lucens* L., *P. perfoliatus* L., *Myriophyllum spicatum* L., *Salvinia natans* L.

We collected plant materials in July-August 2012, 2013 at the shallow sections of the Volgograd Reservoir near a large industrial site, Saratov-Engels (upstream, near Generalskoye village and downstream, near Kvasnikovka village). Sampling and chemical analyses of samples representing sediments and plant materials were conducted in accordance with the Russian Federation Standards [GOST 51592-2000; GOST 26929-94] and with methods listed in the 2001 Agricultural Chemistry Handbook (V. Mineyev, ed.).

It is known that $\text{Fe}^{2+}, \text{Fe}^{3+}$ are main pollutants of the Volgograd Reservoir. *P. perfoliatus* among the studied plants was the concentrator of this element. When studying the accumulation of Cu^{2+} in plants, it was established that *T. angustifolia*, *P. lucens* and *P. perfoliatus* accumulated this metal approximately two times better than other plants. *P. lucens* was the concentrator of Zn^{2+} , and the content of the metal in this plants was 3-7 times more in comparison with other plants. The accumulation of Co^{2+} in all plants was approximately at the same level and averaged 0,82-0,92 mg/kg. When studying the accumulation of Cd^{2+} in plants, it was established that *S. natans* and *B. umbellatus* accumulated metal 1,5-2 times better than other plants.

We discovered that distribution of heavy metal cations (Zn^{2+} , Cu^{2+} , Co^{2+} , Cd^{2+}) in plant organs of *T. angustifolia* followed the usual trend: rhizome > stalk > leaves > inflorescences. This pattern could be explained by the fact that rhizomes and stalks of *T. angustifolia* are perennial, which accounts for their ability to accumulate chemicals for a number of years. When studying the accumulation of Zn^{2+} in *T. angustifolia* collected in the shallow section of Generalskoye, its average concentration was 1.82 ± 0.12 mg/kg. Bottom sediments of shallow-water site contained four times more zinc compared with its average content in plants. Our results have shown that the average Cu^{2+} content in collected in *T. angustifolia* by Kvasnikovka was nine times less than in plants near Generalskoye. Such striking difference was related to the low accumulation of copper by plant rhizome in the area of Kvasnikovka. Perhaps the results could be attributed to the high degree of overgrowing of shallow spots near Kvasnikovka. In bottom sediments collected in shallow waters near Generalskoye, we observed the maximum concentration of Cd^{2+} (three times as much as in plants).

The results of our study suggested that *T. angustifolia* was not active accumulator of heavy metals. However, taking into account that its rhizome is good enough in accumulating chemical elements, we recommend using this plant for treatment and purification of water bodies from heavy metal pollution (such as copper, cadmium, and cobalt). Association of pondweed was active accumulator of heavy metals, and we recommend *P. lucens* and *P. perfoliatus* as the main subjects for conducting diagnostic monitoring of current ecological state of the Volgograd Reservoir.

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APPLICATION OF LOW TEMPERATURE PLASMA FOR ENERGY PRODUCTION FROM RENEWABLE SOURCES

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The Nonprofit Partnership "Techno Eko"
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Waste tire is not only a valuable secondary raw material containing 65-70% rubber, 15-25% carbon, 10-15% metal, but also is a valuable source of renewable energy. Typically 1

ton tire contains about 700 pounds of rubber, which can be reused for the production of fuel, rubber products and other construction materials. Meanwhile, burning one ton of used tires will release into the atmosphere 270 kg of ash and 450 kg of toxic gases. Despite the existing technologies and processing plants, scrap tire and similar waste product recovery does not amount to 15% of the available materials that could be recovered. In Russia only 7% of tires are disposed of in a renewable way. Some technologies and techniques for waste tire processing, such as separation of the metal cord and crumbling rubber, are well developed. Research studies aimed to increase the complexity of the use of crumb rubber by generating synthesis gas and carbon black are still not completed.

This paper presents the results of studies on plasma-thermal processing of crumb rubber in the disposal of used tires. The process is based on radio frequency (RF) induction plasma torch implementation. The advantages of this type of plasma torch are an unlimited life time (no consumable electrodes) and the ability to maintain the plasma almost in any environment and using any processing gas. The temperature in the mixing zone, where the raw material is introduced into the plasma, can vary from 1000 to 8000° C. The preferred temperature is not lower than 1200 ° C because at lower temperatures carcinogenic dioxins could be generated.

At the experimental stage, powdered rubber was fed through the discharge zone or into the plasma jet. The last option appeared preferable since that discharge chamber is not contaminated by carbon. During the plasma treatment (interaction of the plasma with rubber crumb) carbon black and synthesis gas (mixture of hydrogen and carbon monoxide) are produced. The syngas caloric value is slightly lower than of natural gas, but the content of hydrogen and CO is optimal for a variety of applications. The temperature profile in the mixing zone was different for different regiments and depends on the following parameters: plasma power, raw material feed rate, chemical composition of plasma and of the carrier gases, and the gas flow. Therefore it was possible to regulate the ratio H_2/CO by controlling the enthalpy and composition of the plasma. In addition, by varying the process parameters, we obtained no liquid fraction (synthetic oil) in the final products. The absence of liquid phase dramatically simplifies the technological process, because it is not necessary to design and implement equipment for collecting the liquid fraction. The solids (carbon black) were collected in the product container, which is equipped with a line of filters. Preliminary experiments have shown the possible production of carbon black in the nano particle size range (50 to 300 nm). It should be noted that the properties of the carbon black meet the standards GOST (Russia) and ASTM (USA) for carbon black produced from natural gas.

A plasma installation was developed based on a block-modular design that gives us a technological flexibility, that being orientation of the reaction zone (vertical, horizontal or tilted angles). In addition, it is possible to carry out studies of combined, plasma & thermal processing of crumb rubber. In this scheme, the thermal heating was carried out by a low-frequency induction generator.

Preliminary studies of the obtained samples showed that the consumer properties of

carbon black can be used successfully for the production of paints, rubber products, and as a sorbent.

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UNIVERSAL SORBENT PRODUCED FROM AGRICULTURAL WASTE FOR WATER PURIFICATION

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Agricultural waste is one of the major pollutants of our biosphere. For example, more than 60 countries are engaged in the cultivation of rice with an annual harvest of about 100 million tons. This rice generates about 200,000 tons of rice husks with a bulk density of 140 kg / m³ it that equals 1.4 million cubic meters. This enormous volume of waste generates heat, the potential for spontaneous combustion and significant pollution. Burning rice husks is not a panacea as this generates 0.14 million cubic meters of ash.

Most countries, including Russia, forbid the dumping of such waste. Although a small amount of these rice husks are used as fertilizer additives, most of it is not commercially recycled.

In this paper we will describe a serious, novel approach to solving this environmental problem – the use of agricultural wastes such as rice husks and buckwheat hulls for sorbent production that can be used for cleaning the hydrosphere from oil spills.

Using rice husks transformed into sorbents at wastewater treatment plants and in open water reservoirs during scheduled maintenance and emergency situations has demonstrated their competitive advantage. The sorbents were tested for aquatic environmental cleanup from various petroleum products such as Mordovo - Karmalskoye natural bitumen, oil and Uratminskaya Privyatskaya, Neucen deposits, Rio Negro (Argentina) and mineral compressor oils produced in Russia, Hungary and Argentina; oil waste service stations at sites in Russia, the Baltic States, Hungary and Argentina. Sorbent saturated by oil does not sink and can be easily collected from the water's surface. It can also be recycled and reused, or can serve as a high-calorific fuel. Sorbent does not require special conditions for transport and storage or special devices for use on oil spills. Depending on the sorbent type and modification, the absorption capacity (weight per weight of oil absorbed by the sorbent used) is from 3 to 10, with a bulk density of ~ 100 kg / m³, and a surface area of 300 - 1000 m² / g. The efficiency of water purification from oil products is 97 - 99%. Sorbent is also used for the production of oil spill booms and other absorbing devices.

The authors have obtained results that used standard sorbent as a base for a universal sorbent that has a very highly selective capability for extracting various elements from aqueous solutions. Sorbents are used as a matrix that has a unique composition and

distribution of the macro, meso- and micro-pores. New methods of impregnation of the matrix with a model solution (impregnation) and attachment to the surface of the matrix modifier (immobilization) have been developed. Plasma-chemical modification of the surface of this carrier matrix allows the application to the surface and as well as the possibility of introducing various reagents into the pore of the matrix. Thus, the composition and physic-chemical properties of the matrix change and enhance the sorption of different elements from solutions. For example, the sorbent, obtained from rice husk was modified by SiO_2 nano-powder that includes silicon oxide, silicon oxide nano-powders and allows us to create a stable homogeneous material structure based on silicon. Positive results were obtained for deodorization of de-watered sewage sludge by potassium carbon-containing sorbent from buckwheat hulls.

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INVESTIGATION OF THE EFFECT OF METHANE AND SULFUR VAPOR TO REDUCE THE OXYGEN CONCENTRATION IN THE SULFUR GASES

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It is known that at the metallurgical enterprises to improve process performance along with heated air began to use air, enriched with oxygen. With increasing oxygen content increases the concentration of sulfur dioxide in the flue gas. This leads to a significant increase of efficiency of utilization of sulfur gases.

It is established that the temperature recovery, supported in the reactor depends on the oxygen content in the recycle gas. Calculations showed that the catalytic process in the processing of sulfur dioxide feasible only for gases containing up to 2.5 % oxygen. Therefore there is a need to develop a process for the recovery of sulfur dioxide used at high oxygen content in sulphur dioxide.

The aim of the study was preliminary deoxygenation source of sulfur dioxide from free oxygen methane and vaporous gray to the catalytic reactor.

In order to conduct the process of recovering sulphur dioxide by the catalytic method preliminary deoxygenation (before catalytic reactor) source of sulfur dioxide from free oxygen methane. High speed sulfur dioxide, which is explained by the initial conversion of methane with oxygen to more active reductants (H_2 , CO).

It is established that the optimal process parameters are: temperature 850°C ; the volumetric rate of $500\text{-}3000 \text{ hour}^{-1}$; degree of deoxygenation 95-96%. The yield of elemental sulfur after the first stage at a temperature of 800°C was 65-68%.

Use as deoxygenation agent vaporous sulfur (temperature of $600\text{-}650^\circ \text{C}$ volumetric rate $6000\text{-}8000 \text{ hour}^{-1}$; $\text{S:H}_2 = 1,2\text{-}1,4 : 1$, degree of deoxygenation 87-97%). The

concentration of sulfur dioxide in the composition of the gas entering the catalyst increases, the recovery of which leads to increased release of sulfur by 5-6%.

Marina Gassiy

WATER SUPPLY AND WASTEWATER DISPOSAL IN A CONTEMPORARY RUSSIAN MEGALOPOLIS. TECHNICAL, ECONOMIC AND LEGAL ASPECTS (EXAMPLE OF ST. PETERSBURG)

SUE "Vodokanal of St. Petersburg", St. Petersburg Russia

St. Petersburg is one of Russia's largest industrial centres, and has the second biggest population of over 5,000,000 people. In view of that, good quality water services should be provided for our city.

The centralized water supply and sewerage systems in St. Petersburg are among the most advanced ones in Russia. The systems are operated by SUE "Vodokanal of St. Petersburg".

Adequate treatment of wastewaters in our city started in 1978 when the first treatment plants were put into operation to treat 27 % of the total municipal wastewater volume. By now the treatment level has grown to 98.4 %. In the near future (not later than by 2020), 100 % of wastewater volume will be discharged treated.

Today, the centralized sewerage system in St. Petersburg comprises 8,240.6km of sewers, 241.1km of tunnel collectors, 141 sewage pumping stations, 15 treatment plants and 3 sludge incineration plants. It should be noted that St. Petersburg is the world's first big city to solve the problem of sewage sludge disposal.

Likewise, the centralized water supply system in St. Petersburg has a complex structure. One of the basic development principles for this system is a step-by-step elimination of hazardous production processes that might have a negative impact on the city environment. For example, we could fully stop using liquid chlorine for water disinfection in 2003-2009.

Today, the centralized water supply system in our city comprises 6,865.7km of pipelines, 9 water treatment plants and 198 boosting pumping stations.

The operation of centralized water systems is supported by the flexible economic development model of our company. The assets operated by SUE "Vodokanal of St. Petersburg" are owned by the city. The company activities are tariff-based; the tariffs are established by the St. Petersburg Tariff Committee, one of the city authorities. Any goods and services required for our activities are procured through tenders to ensure optimal value for money. A complex structure of financing is used for big projects implemented by the company where both budgetary funds and external investments (e.g. by international financial organizations, such as EBRD) are used.

The sphere of legal regulation of water supply and wastewater disposal is being reformed. Our company is one of the sector leaders and therefore we can take an active part in the development of new regulatory framework. Regulation in this sphere is based on the sectoral federal act - the Law of Water Supply and Wastewater Disposal, and over 20 regulatory legal acts adopted in pursuance of the Law. Moreover, self-regulation of water supply and wastewater disposal may be applied to some customer categories at local levels. In St. Petersburg, such regulatory system was developed with close participation of our company and has been functioning successfully over two dozen years..

V.V. Gavrilenko

MAIN PROBLEMS OF ECOLOGICAL GEOCHEMISTRY IN ST. PETERSBURG AND OTHER LARGE CITIES

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At present, ecological geochemistry is one of the most central research fields in the area of geosciences because it is not only connected with the human life, but also with the life on Earth in general. Biosphere is not just an “environment” for living beings, it is rather a system of geochemical and geophysical bio-inert interactions, in which intensive chemical and energy processes take place on the border between different types of matter – living and inert (nonliving) – while changing each of them. For this reason, the term “environmental geochemistry”, typical for scientific literature in the West, is not always correct enough; we apply the term “ecological geochemistry”.

Ecological geochemistry is a direction in geochemistry which researches interconnections between living and inert matter on the level of chemical elements as forms of organisation of matter.

Millions of people live in large cities in which, as a rule, geochemical situations are very much different from normal natural conditions. Water and air monitoring is an important condition for the health of population. However, territories which have been gradually accumulating toxic components for a long time can only be detected during the examination of soil and bottom sediments as indicators of such an accumulation.

Many types of geochemical anomalies are found under various geoeological conditions. However, it is possible to arrange them into groups according to the main geochemical factors in order to point out the most dangerous ones for each specific city:

Natural regional factors, associated with the city's confinement to the main geological structures and geochemical fields in the region as well as specific climatic and landscape zones. In particular, the natural regional factor for St. Petersburg is its location on the border between the territories of the East European Craton and the Fennoscandian Shield. This is reflected in the structure of the Gulf of Finland, in the difference in the nature of erosion between its northern and southern shores, in the composition of its bottom sediments as

well as in different hydrogeological and landscape conditions of the northern and southern parts of the city.

Anthropogenic regional factors are primarily caused by a long-range air and water transport and its effect on the regional towns along its path of motion. It is most clearly manifested in the content of radionuclides in the soil and bottom sediments in cities which were “covered” by the fallout after the Chernobyl disaster.

Natural local factors determine the local water and air situation under specific geological and geochemical conditions. For example, the presence of the Ordovician horizon of black shales within the city limits of St. Petersburg determines the radon danger zone in the southern part of the city. The position of buried valleys determines geotechnical risks which might happen, for example, during underground construction works. The dominating air circulating system has its effect on the distribution of the precipitation of pollutants in different parts of the city.

Anthropogenic local factors is the most complicated and difficult to analyse group of factors when studying geochemistry of large cities. They represent a set of constantly changing sources of harmful substances in the air, soil and water discharge depending on the changing direction of industrial activity in different parts of town.

The identification of specific factors in the formation of geochemical fields and anomalies is a major problem in the ecological geochemistry of large cities. From the point of view of geochemistry in the area of life activity, a particular risk is created by domestic and industrial waste landfills. There is no safe disposal of these landfills in Russia, which puts the population in cities at additional ecological and geochemical risks.

Luidmila Glinyanaya

CONTEMPORARY IMPLEMENTS OF ENVIRONMENTAL EDUCATION ILLUSTRATED THROUGH THE INTELLECTUAL ROLE-PLAYING GAME “GREEN ECONOMY”

State Institution of Culture “Moscow Youth Multifunctional Center”, Moscow, Russia

Modern people living fast paced lives don’t often pay attention to the fact that our natural environment is still deteriorating. At a personal level it is a difficult problem that’s often easiest to ignore or brush aside – we have so many pressing day to day problems that seem more important.

At a governmental level, each country has the urgent problems of economic growth, political stability, along with social and cultural priorities. However, the world environmental situation affects not only each individual state, but also every person living on this planet. What could be done to stop waiting and start acting?

The Moscow Youth Multifunctional Center is one initiative to help answer this question.

The Moscow Youth Multifunctional Center was created with the support of The Moscow City Department of Culture to give the youth of Moscow the opportunity to bring their ideas to life and grow personally in a comfortable and favorable environment.

The Moscow Youth Center organizes lectures, training, workshops and brainstorming sessions dedicated to wide ranging topics: business, innovation, volunteering, international affairs, and of course environmental issues. We invite the best professionals: top coaches, consultants and practitioners to work with our youth, assisting them to improve themselves. Specially equipped rooms such as a print studio, mini co-working zones, and a graphic studio also facilitate the transformation of incredible fantasies into real life projects.

The Environmental situation of Moscow city is a special topic of focus for the Moscow Youth Centre, where specialists deal with environmental education and raising environmental responsibility among youth. Currently the priority task for Moscow youth at the Center is to find solutions to global environmental problems. Once initiative stemming from this was the idea to unite all environmental organizations into one project "Eco – leader school". The main aim of this school is to involve the Moscow youth in modern environmental projects and thus to take responsibility for their city, nature and country. Besides organizing different city events, the educational program has been created to teach Moscow citizens and students how to protect their environmental rights, how to organize an environmental event, how to adopt a more environmentally friendly way of living in the city.

The young generation is the force behind creating a future without global warming, environmental pollution, poaching and environmental depletion. The "Eco-leader school" project aims to foster such people and organizes an intellectual role play called "Green Economy", which was created for school students. During the preparation stage, participants of the role play study international documents, principles of sustainable development and "green" economy. They learn modern concepts of the world economy and better understand problems which their generation face. The mission of this game is to reduce the total "ecological" footprint of each team. In this game, participants try to earn as much special currency (called "Zhiviks") as possible, and It's only possible to earn currency by giving the correct answers to the questions which are based on the international documents studied by participants during the preparation stage.

Through this project, the "Eco-leader school" initiative unites all the environmental communities of the city, helping to increase education and awareness in the environment among Moscow citizens, school children and students.

Over the last 10 years Russia has been paying due attention to environmental problems and has been developing a culture of consumer waste treatment. 2013 was thus declared the year of environmental protection, and the whole country was oriented at solving ecological problems both by direct actions and by education projects. The Moscow Multifunctional Youth Centre was tasked to raise awareness among the youth of an environmentally friendly lifestyle.

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NUTZUNG DEN KIPPBÖDEN IN DER LANDWIRTSCHAFT

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Heute, wo das Tempo der Kohlebergbaus steigt mit jedem Jahr, und die Landwirtschaftliche Flächen stark abnehmen, ist der Rückkehr von ehemaligen Industrie-Gebieten sehr wichtig. Erreicht wird es durch die Rekultivierung, die auf die Stimulierung der Selbstheilungskräfte der Ökosysteme gerichtet ist.

Derzeit auf dem Territorien Gebietes Kemerowo, wo sich die großen Bergbau-Unternehmen befinden, werden die folgenden Technologien der landwirtschaftlichen Rekultivierung genutzt:

1. Landwirtschaftliche Rekultivierung ohne die Verwendung irgendwelche Bodenverbesserung – auf diesen Flächen nach der Ausrichtung der Oberfläche wird die Gras-mischung gesät und werden als Grünland oder Weiden genutzt.
2. Grundstücke der landwirtschaftlichen Rekultivierung mit dem auftragen der potentiell fruchtbaren Rassen (aus Lehm und Ton) oder Mutterboden - in Abhängigkeit von der aufgetragenen Schicht wie Ackerland oder als Grünland verwendet werden können.
3. Rekultivierungsflächen mit Bodenverbesserungsstoffen (Torf, Huminstoffe, Zeolithe und andere), die Verwendung als Grünland oder Weiden.

Das Substrat den Kippen ist aus dem Abraumaterial hergestellt. Im Grunde sind es Sandstein, Tonstein, Siltstein und deckt Lehm und Ton. Alle diese Gesteine sind nicht toxisch in diesem Zusammenhang ist die Nutzung den gebildeten aus dieser Rassen Böden bei der Herstellung von landwirtschaftliche Produktion zu verwenden. Jedoch ist es notwendig die hohe Dichte dieser Bereiche unterzeichnen, die hauptsächlich mit der Verwendung von schweren Maschinen bei der Bildung der Kippe verbunden ist, sowie die hohe Dichte des Abraumaterials. Auf den Grundstücken der Rekultivierung ohne den Einsatz von Löss-Lehm und Mutterboden ist notwendig hohen Dosen Dünger einbringen um die hohe Erträge zu bekommen.

Abhängig von den Reserven der Mutterboden Macht bei der Anwendung variiert sich die aufragende Schicht von 20 bis 50 cm. Selbst mit einer solchen Macht in Zeiten Auftauen und Einfrieren der Bodenschicht ist das Wachstum der großen Steine aus den unteren Schichten des Bodens zu bemerken. Dieser Wachstum den Steinen behindert die Bodenbearbeitung und ihre weitere Verwendung bei der landwirtschaftliche Nutzung den Kippflächen.

Aufgrund der Tatsache, dass die Kohleflöze in der Region Kemerowo sind unter leistungsfähigen Schichten aus Löss-Lehm, dessen Kapazität erreicht 30 Meter und mehr, in diesem Zusammenhang ist es möglich die Kippflächen mit dem Lehm über einen Meter überdecken. Darüber hinaus werden diese Bereiche in erster Linie für die Anpflanzung von Baumkulturen eingesetzt.

Wenn auf den Kippflächen den Bodenprofil mit einem leistungsfähigen, mehr als

einen Meter, lehmiger Horizont und 40 - 50 cm von Humushorizont wiederherstellen wird es möglich sein diese Bereiche als Ackerland einführen. Obwohl bei der Lagerung der Fruchtbaren Schicht ändern sich ihre physikalische und chemische Eigenschaften, bei den Eintrag an den notwendigen Dosen von Düngemitteln und der Erfüllung aller technischen Maßnahmen wird es möglich hohe Erträge von landwirtschaftlichen Produkten zu erhalten.

Schlussfolgerungen

1 Der Wiederaufbau auf den Kippflächen den Bodenprofil hilft den ökologischen Zustand der Region zu verbessern und der rasche Rückkehr den Flächen zur landwirtschaftlichen Nutzung.

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PROFESSIONAL VICTIMIZATION AS A DETERMINANT OF RISK-INDUCED SITUATIONS IN THE PROCESS OF LABOR ACTIVITY OF WORKERS OF MINING COMPANIES

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Introduction of the integrated automated information-measuring systems in coal mines has reduced the risk of occupational hazards. But despite the efforts technical measures to enhance the security situation in the mining industry is still far from perfect, which necessitates the search for new paradigms of evaluation of the current situation. Causes of failures of technical systems may be due not only to design, technological, operational defects, but also the human factor, because there is always the psychological and physiological characteristics of the individual match the level of complexity of tasks and characteristics of the labor process. It is believed that around 16 - 20% of healthy people are not able to master a number of different professions in complexity due to the mismatch of psychophysiological parameters of the requirements of the labor process, which leads to overvoltage regulatory systems and the risk of failure of adaptive processes. Analysis of the current situation in the mining industry allows suggesting that the miner's social portrait profession professional victimization acquired traits, largely due to the professional ambivalence in which the alternate signs of heroism and sacrifice. In addition, today, in terms of devaluation of heroism profession dominated the second component - the victimhood, which reflects the social component of the process of victimhood. Today, professional risk, danger fatal acquired traits that contributed to the sacralization of the profession miner. The building of temples, chapels in memory of those killed in accidents miners, is the official recognition of professional victimhood, which, on the one hand, acts as a condition characterized by a feeling of tension, anxiety, fear, anxiety, apprehension, and on the other - as the property of implementing genetically determined program, accompanied by painful sensations of anguish, panic, fear, powerlessness. All this creates a special "negative risk-induced plant" in the mining environment on victim behavior

to the conditions of employment and may cause the growth of mining accidents. Today the problem of adaptation to the profession largely due to the resolution of the contradiction between the ever-increasing complexity of technical systems in the mining industry and the requirements of art. Already, about 16 - 20% of healthy people in their physiological parameters do not fully meet the requirements of current employment. That discrepancy possibilities personality planned current requirements of industrial environment initiates the growth of the state of stress asthenic to negative emotions. And if sthenic reactions can be regarded as biologically useful, can mobilize the body's resources to achieve this goal, the asthenic - act as protective embodying the refusal to reach the goal, which is accompanied by inadequate assessment of the situation. Analysis of coping strategies among students, professionally oriented towards their future profession, showed that 21% of surveyed prefer the strategy of avoiding problems. Considering the triadic structure of system management (goal-means-results), the conditions of occurrence of stress can be expressed by the general formula:

$$\Omega \approx R(\Sigma(J_1, E_1, T_1) - \Sigma(J_2, E_2, T_2)),$$

where Ω -state voltage; R - goal-setting; (J_1, E_1, T_1) - information respectively, the energy, the time necessary for the body to achieve this goal; (J_2, E_2, T_2) - respectively, information, energy, time available to the body. Therefore, if $(J_1, E_1, T_1) > (J_2, E_2, T_2)$, then there is a state of tension, the level of which determines the choice of coping strategies with negative situation. But if the process of work divided into the following periods: current, emergency period and the period of the actual accident, it should be noted that in each period will increase the number of professionals who are on their physiological parameters do not meet the requirements of the work period. Each conditional period of employment gains its features professional ambivalence resulting complexity of tasks and human capabilities, initiates the process of victimhood. Thus, the dual nature of professional victimhood is based on three pillars: social, physiological and psychological, analysis of the importance of each of them allows a more detailed analysis of the causes and mechanisms of technological accidents and disasters, which is especially important now, when "sick generation" or "generation Z" comes.

Ekaterina Iakushina

ENVIRONMENTAL VOLUNTEERING AND PROMOTION OF ECO-CONSCIOUS YOUTH IN MOSCOW

State Institution of Culture "Resource Centre for Support and Development of Volunteering "Mosvolonter", Moscow, Russia

Currently in Moscow you can see high level of social activity towards the solution of environmental problems. However, we need to systematize and unite all separate actions, which are now exist in the city. State Institution of Culture "Resource Centre for Support and Development of Volunteering "Mosvolonter" became one of the organizations that

took the responsibility of uniting all eco-activities and developing voluntary movement in Moscow. Activity in this direction is incorporated into a project called “Eco-Exit”.

For us, eco-volunteering is primarily a method to change the way of thinking and consciousness of every citizen. As we know, all changes in the world starts with changing of ourselves. An eco-volunteer is a person who cares: he takes a proactive stance, promoting an eco-friendly lifestyle and become an example that can inspire and encourage others.

Young people who attends for our voluntary action become aware of the need of their personal involvement. And our task is to create proper conditions for their involvement in active work and self-development. A year ago The Mosvolonter created the Volunteer School, where youth gain valuable professional and personal qualities. After a course of training programs, graduates are able to independently initiate and coordinate social and environmental projects. Weekly we meet with them to conduct on-going projects and to provoke their motivation. When we are working with volunteers, we always imply individual approach. It is important to identify talents and characteristics of each individual and give relatable knowledge, which would help him to develop and obtain the necessary skills specific to him.

Within the framework of the project “Eco-Exit” volunteers monthly, at least one time per week, organize a variety of events, from tree planting to educational projects, and also carry out eco-promoting activities on online platforms, such as spreading of eco-ideas in social networks and organizing of the competition of eco-movies. Also in cooperation with the Moscow Youth Multipurpose Center volunteers set up large urban environmental actions. Within the first six months of the “Eco-Exit” project, we have implemented more than 20 different events and activities.

Those volunteers who once came to our one-time event after a few months already are able to organize larger-scale projects, ultimately improving the performance of entire structures like universities, schools and companies. There are some volunteer centers that appear on the basis of universities. Their work includes volunteering in animal shelters, gardening, working on recycling issues, etc.

As part of the Mosvolonter program, and together with Moscow Youth Multipurpose Center, we’ve implemented the “Green Office” project. This project aims to develop a corporate eco-culture within the employees of the partner organizations and eco-volunteers. We develop techniques for making office more eco-friendly and these techniques can be used in any organization. To evaluate the effectiveness and implementation of accounting features, we firstly apply them to our own work. In addition to distributing these Green Office techniques, we aim to share the experience for all its activities with NGOs in Moscow and other regions that have had successful practices being used in other cities.

We are already observing the positive results of our work and are planning to maximize coverage of the organizations participating in the project. “Mosvolonter” will continue to be active in promoting ecological awareness and educating of adolescent generation, which is gentle on the environment. Because only when we save our planet we can speak about brighter future.

V.I. Ilyin

ECOLOGICAL MOVEMENTS IN MODERN RUSSIA

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On the verge of the 80s-90s of the 20th century the ecological movement in Russia had attributes of the political actor whose judgments and views had to be taken into account at different levels of political power, including the highest ones. In many cases the ecological movement would give the initial impact to the process of modernization, in the national republics in particular, where the tasks of environmental protection were associated with the aims of the national movements. Later, however, the decrease of the first wave of general democratic processes, the establishment of the regime of governed democracy and stagnation in the development of working mechanisms of political competition as an instrument of involvement of citizens into the political life and keeping up the balance of interests of different social and political groups began to restrict the opportunities of control over the actions of institutes and actors of different levels causing damage to the environment. Under the circumstances there arose a danger that further aggravation of ecological problems could result into manipulating public consciousness as well as social and political disturbances.

The low level of well-being of the population, the course of the development of the society based on the exploitation of natural resources are considerably limiting the opportunities of the ecological movement as a political subject that expresses the right of the citizens to favourable environmental conditions, do not allow the ecological movements to have active social support of the population that sometimes perceives the slogans of such movements as manifestations of extremities and Utopia. That is why the most important task at present is the development of an effective mechanism in the system "community of experts – state – the public".

The public ecological movements have at their disposal important instruments to enhance their effectiveness.

Firstly, they can organize their activities on the qualitatively high competence basis, because they have no restrictions concerning the involvement of project performers as compared to the official structures that have to rely on the professional and intellectual potential of the limited staff.

Secondly, informal ecological organizations have much more freedom while choosing the subject matter for their activities, they can respond in a prompt way to new circumstances and information, react to problems more accurately, look for new ways and means without wasting time on endless agreement procedures at different bureaucratic stages.

Third, they have such an advantage as greater freedom in searching material resources to provide their activities. Many potential sponsors respond more quickly to the needs of public, not state organizations.

As regards the interaction of the state and public ecological movements it should

neither be limited to mutual criticism nor allow preventing their activities. More over the state bodies should render any help including financial and that of experts to develop the ecological movements.

R.R. Kafarov

**PATHS OF OPTIMIZATION OF OPERATION OF TUBE-TYPE
FURNACES ORF AFTER 20 YEARS OF EXPLOITATION"**

Baku, Azerbaijan

The tube-type furnaces are main customers of combustible on ORE, therefore their optimal operation is defining for economics of the oil-refining complex. The progressive engineering decisions, foreseen in the projects of furnaces during exploitation are step-by-step lost and coefficient of performance is slashed on tens percents.

However, if the coefficient of wear of main design clusters of furnaces is not yet great, there is a possibility of recovery of a primal level COP. The optimization of operation of tube-type furnaces requires first of all conducting comprehensive investigation with usage of modern instruments for mining and realization of a complex of measures on recovery of work capacity of tube-type furnaces, rise their COP. The similar operations were carried out in 1997 - 98 at the Baku oil refining associations "AZERNEFTIANADJAG" and "AZERNEFTJAG". The method of conducting an investigation of tube-type furnaces accompanying their technological accounts, subsequent analysis of results and development of concrete measures on optimization of operation of tube-type furnaces held on above mentioned plants, can form the basis for conducting similar investigations on furnaces of technological complexes of the refineries, which lost the primal plant-performance figures.

A.A. Kasyanenko
G.A. Kulieva

**ENSURING RADIATION SAFETY WHEN HANDLING
RADIOACTIVE SOURCES AND WASTES IN THE RUSSIAN
FEDERATION**

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The production of the thermal and electrical energy on the Nuclear Power Plants continuously increases in the whole world, despite the prominent radioactive accidents (such as Chernobyl NPP, Fukushima NPP, etc.), negative social opinion, political and economic factors. The radioactive sources are world-widely used in science, medicine, industrial and agricultural sectors and practically in all other sectors. In Russia the radioactive sources of ionizing radiation are used in more than 16 thousand organizations,

including scientific, medical, industrial, etc. All the stages of dealing with atomic energy sources, starting with extraction and processing of radioactive ore, production of atomic energy, production, using, transportation, decommission and any other kind of operations with radioactive sources, threat of radioactive impact to the personnel and population; more than that they are followed by formation of radioactive waste (RAW). That's why the most important question at all stages of dealing with radioactive sources of ionizing radiation is the providing of radiation safety (RS).

The International Commission on Radiological Protection (ICRP) is elaborating the basis for radiological protection standards. The recommendations of ICRP are addressed to organizations that adjust, operate and to other organizations and agencies in various countries, each of which develops its own regulating documents (legislative and normative). The publications of ICRP were used when elaborating the law "On Radiation Safety of the Population" and standards of radiation safety (SRS-99). In the law (art.9) the Commission recommended an average annual permissible dose: 1 mSv for the population, 20 mSv for the personnel. The equivalent doses are added to SRS-99: 150, 500 and 500 mSv for eye crystalline lens, skin and extremities accordingly. In 2007 the Publication 103 ICRP was issued. In Russia it was published in 2009. It was a kind of guidance, where were explained new concepts of providing the radiation safety.

"The international basis safety standards for protection against the ionizing radiation and for the safety of radiation sources" currently co-sponsored by the International Atomic Energy Agency (IAEA). The document "Categorization of radiation sources" is the consequence of the carried-out works. On the basis of this document Federal Service of the Russian Federation for Surveillance in Consumer Rights Protection and Human Welfare has developed and issued "The Methodology of categorization of the closed radionuclide sources on potential radiation hazard".

Federal law "On Use of Atomic Energy" specifies the legal basis and principles for regulation of relations, arising in the context of using the Atomic Energy and norms of international relations. Federal law of 25 June 2012, No 93 amended article 36.1 of Federal law "On Use of Atomic Energy", concerning the organizations which carry out to activities on operating with radioactive sources, containing of only radionuclide sources the 4th and the 5th categories of radiation hazard. These kinds of organizations are not recognized as operators and they are liable to the official registration in the procedure, prescribed by the Government of the Russian Federation (without any licensing).

The law of 30 March 1999 "On the Sanitary and Epidemiological Well-Being of the Population" sets the government regulating and state supervision of compliance with legal and regulatory documents.

Dealing with RAW the Russian Federation has signed and ratified the amended "Convention on the Physical Protection of Nuclear Materials" (1980), "Convention on Assistance in the Case of a Nuclear Accident on Radiological Emergencies" (1986), "Convention on Early Notification of a Nuclear Accident" (1986), "Convention on Nuclear Safety" (1994).

Law No 190 of 11 July 2011 was adopted “On Radioactive waste safety management and on Amendments to a Number of Legislative Acts of the Russian Federation”. The law divided radioactive wastes into wastes produced before and after the entrying the law into force. The new classification for the wastes, produced after it, was carried out in accordance with the International documents.

In 2010 and 2013 on the basis of documents IAEA and ICRP the necessary amendments were made in “Basis Sanitary Rules of Providing Radiation Safety (BSRPTRS -99/2010). Sanitary Regulations and Standards. //SR2.6.1.2612-10” and in “Sanitary Regulations for Radioactive Waste Handling (SRRWH -2002) SR 2.6.6.1168-02”.

All the mentioned above affirms a good coherence of legislative and regulatory documents of the Russian Federation with the International Organization documents, among them IAEA and ICRP.

To have a required level of radioactive safety in all the organizations dealing with radioactive sources and RAW, and, moreover, with generation sources of ionizing radiation, the advanced studies of leading workers and specialists of the programs on radioactive safety, radioactive supervision and of training programs - are necessary at the level of legislation in the Russian Federation. So, in article 35 of law “On the Use of Atomic Energy”, the most important requirements of operation organization are selection, training and maintaining of the employees’ skills at nuclear plant, radioactive source and the storage. Article 11 “On Radioactive Safety of Population” forces private entrepreneurs and legal persons to provide the employees with hygiene training. Training and certification on providing radiation safety of employees, specialists of radiation safety services and other persons, who works with a radioactive source permanently or temporary – are required by paragraph 2.5.1 of BSRPTRS -99/2010.

Scientific and Research Center for Radiation Control and Environmental Monitoring (SRCRCRM) of Ecological Sciences Faculty of Peoples’ Friendship University of Russia (RUDN) organizes qualification training to programs of Radiation Safety and Radiation Monitoring, 72-hour course for Supervisors and Specialists, working with the sources of ionizing radiation, both radioactive and generating ones.

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RATIONAL APPLICATION OF OIL PARAFFIN

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Solid petroleum paraffins are generic products. They are used in the production of more than 450 products for different purposes. Demand for paraffin continues to increase with the growing scarcity of paraffin oil materials. Manufacture of ceramic

products for radio engineering and electrical engineering by method of hot pressure casting is one of the important directions of using solid paraffin. It is used as an interim technology bundles here. Paraffins should have the necessary combination of operational and physical and chemical properties due to the chemical composition and crystalline dispersed structure depending on the application. Knowing this information is necessary for the management and disposal of wastes paraffin production.

Commodity paraffins subdivide into purified food (P) and treated (B) on the degree of purification. In the petroleum refining industry paraffins produced from distillate fractions of oils (673-693K) and constitute 70-90 % concentrate of n-alkanes and aromatic hydrocarbons. The arena contains of ~3 0.3%, depending on the degree of purification, the remaining hydrocarbons are isoalkanes and cyclic alkanes. Melting temperature, oil content, color, availability are water soluble acids, alkalis, mechanical and other impurities are parameters in which controlled technological process. Information about which of the petroleum hydrocarbons are carriers of strength, and which weaken their dispersed structure, is important for paraffins and their compositions with given properties and rational using. It is important to know the relative influence of each group of hydrocarbons on the thermal and structural and mechanical properties of paraffin.

We have researched the model of the system. Synthetic tetrakozan n-S24N50 ($T_S = 323.8 \text{ K}$, $P_m^{293} = 5,4 \text{ MPa}$, $\Delta V_{TS}^{293} = 19,9\%$) and dearomatized concentrate of n-alkanes paraffin P-1 ozeksuat oil mixture with a total content of isoalkanes and cycloalkanes 7% were paraffin base. Liquid admixtures monocyclic and bicyclic aromatic hydrocarbons, as well as isoalkanes of oil almost equally reduce T_S , P_m^{293} , ΔV_{TS}^{293} at its concentration $C = 2 \div 20 \text{ wt } \%$. When small quantities of these impurities (up to 2 wt.%) and undermine and weaken the oil on the Crystal structure of n-paraffins sometimes appears more effective than the viscous aromatic hydrocarbons (when $C = 2 \text{ wt. } \%$ in concentrate n-alkanes of oil paraffin $\Delta T_{Sm} = 4,5 \text{ grad}$ vs $\Delta T_{Sap} = 1 \text{ grad}$). It is important that solid impurities isoparaffins and cyclic alkanes ($C = 0,1-20 \text{ wt. } \%$) almost equally as the liquid contained in the oil, reduce the strength and disperse structure contraction n-S24N50.

The prevailing influence of solid and cycloalkanes to values ΔV_{TS}^{293} and P_m^{293} n-S24N50 effect in concentrations up to 7-10 of the masses. % and then is quite low. The 7-10 wt% of these hydrocarbons are reduced to 1.55 P_m^{293} and ΔV_{TS}^{293} up to 18%, i.e. to the level of strength and stabilization of purified concentrate of n-alkanes paraffin oil contains 7 wt% isoalkanes and cycloalkanes ($P_m^{293} = 1,6 \text{ MPa}$, $\Delta V_{TS}^{293} = 17,9 \%$). We recommended that the equation for the calculation of relevant impurities in paraffins, which set its properties, as well as the accounting definition of properties with known gang members. This will modify the structure of paraffins and their compositions, as well as the use of technical grade paraffin instead of expensive species.

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PHYSIOLOGICAL SPERMATOGENESIS PARAMETERS IN MEN LIVING IN THE ARAL SEA REGION

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The Aral Sea environmental health crisis is one of the most global problems of today. The existing environmental problems in the region are reflected in the health of the population, which causes metabolic disorders in the body, leading to the development of pathologies. The disorders of the endocrine system and immune condition have already been established, but the state of the male reproductive condition in the region still remains unexplored. This has determined the critical task of our research.

The objective of the research was to study physiological changes of spermatozoa in the Kyzylorda region affected by the environmental disaster.

Materials and methods. We have observed 189 men in the reproductive age between 20-29 years of old who live in the Kyzylorda region. 82 of them live in the environmental crisis zone in the town of Aralsk and 107 in the settlement of Shieli. A 10-fold dilution of semen was used for microscopic examinations. The following parameters were determined: the number of active and non-active spermatozoa forms (with a fast and slow progressive motility, non-progressive motility, immotile spermatozoa); spermatozoa concentration in 1 ml of the semen, total number of spermatozoa per ejaculate. For the qualitative and quantitative semen characteristics, we used reference values for human semen characteristics suggested by WHO.

Results and discussion.

During the research of physiological spermatogenesis parameters in the group of men mentioned above we determined that the combined effect of ecotoxics (salt dust aerosol, heavy metals, pesticides etc.) led to a decrease in the reproductive function. The number of fertile spermatozoa among men living in Aralsk, compared to the WHO values, was 35.8%, decreased productivity was established in 44.2% and infertile spermatozoa in 20%. In the case of men living in the settlement of Shieli, the amount of fertile spermatozoa made up 54.5%, decreased productivity 32% and considerably decreased fertility in 13.5%.

Based on the research results of spermatogenesis in men living in environmentally unfriendly regions of the Kyzylorda region it was possible to establish that the maximum increase in the number of motile spermatozoa forms took place among men in the settlement of Shieli and that of immotile forms in men in the town of Aralsk.

This way, all the examined men living in parts of the Kyzylorda region show deviations from the physiological reference values for human sperm, which explains a negative impact of ecotoxics on spermatogenesis and leads to the development of a pathologic process.

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RESEARCH OF AMBIENT TEMPERATURE AND SURFACE POROSITY IMPACT ON COMPOUNDING PROPERTIES OF GYPSEOUS DRY BUILDING MIXTURES (DBM)

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Long-term work experience in dry building mixtures indicates that environmental variables exert a material impact on technological properties of gypseous dry building mixtures. Systematic observations indicate that the nature of solidification and solidified surface properties changes abruptly at a high ambient temperature which is characteristic for Azerbaijan (35–45°C) during the summer. In spite of identical chemical-mineralogical and granulometric composition, properties of DBM deteriorate significantly, solidification is uneven, indurated surfaces scatter as a result of insignificant effect. Observation indicates that these processes also occur most intensely in those places where intensive ventilation is admissible. Compositional analysis of scattered surface indicates that the considerable part of its semiaquatic gypsum may not be hydrated. It is primarily associated with a high ambient temperature with which, in our opinion, semiaquatic gypsum has no time to hydrate due to the rapid evaporation of water from system. In our opinion, one of the reasons for insufficient hydration consisted in the fact that certain part of the injected water is absorbed in pores of the treated surface.

For the purpose of in-depth research of surface condition and ambient temperature impact on the quality of the solidified surface some experiments were conducted on different surfaces, which differ in pore content in various temperature and humidity conditions. Surfaces after application and solidification were exposed to X-ray phase analysis. As a result of the received data handling there is a direct correlation between the composition of nonsolidified surface and surface porosity and the intensity of the premises ventilation. Consequently, we proposed a selective approach to the compositions while surface processing with gypseous dry building mixtures and the necessity for consideration of surface condition and environmental factors during the execution of such work. As a result of the research and the received data there were given relevant recommendations for optimizing of DBM compositions on the basis of the alabaster binding.

N.Ya. Kirilenko

IMPROVEMENT OF LOCAL VENTILATION

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To ensure maximum productivity of animals and their high resistance to diseases favorable environmental factors in their environment should be created.

A technical solution to a device for feeding animals is offered, which combines both functions of feeders and functions of an air distributor, which provides aimed local flow of fresh air directly into the feeding area.

The feeder contains a feed chute with transverse walls with internal closed cavity. Internal cavities connected by pipelines to supply pipelines for the supply air. In the upper parts of side lateral surfaces of walls vents are made.

Cross partitions can be made in the form of flat vertical ducts, or in the form of the supply of triangular cross-section air ducts, which lie at the bottom of the gutter.

Feeder works as follows.

Air is supplied by the pipeline through pipelines in the inner cavity walls and out through the vents, providing normalized parameters of microclimate in the area of the feeder.

The air exhaled by animals, is removed from the zone feeders General exchange ventilation system or directly through the holes, the internal cavity, pipelines for fume main pipeline outside the premises.

In the case of opposite counter collision expiring jets rapid quenching flowing stream, ensuring a comfortable condition of the animals in the area of the feeder.

To improve ease of operation of the feeder features advanced design, where the ducts are not directly associated with the design of the feeder, but only to provide an adequate supply of fresh air and discharge of exhaust air from the feed.

We offer a new and effective method of ventilation of the facility, which enables creating around animals on the sides of the air flow along the length of his body. The air flow is directed horizontally from the front of the animal's body to his back. Air stream directed in such a way, which allows refreshing the air around the animal from ammonia and carbon dioxide, which, which significantly improves its condition.

Ventilation device livestock house contains stall with intake and exhaust perforated tubular side rails related to the exhaust trunk pipelines. Supply and exhaust perforated pipe fence vertical and horizontal each other on the opposite front and back of the stall, respectively. And the holes in the exhaust perforated pipes were made on opposite sides.

Edgar Klose

**ENTWICKLUNG UND UMSETZUNG AUSGEWÄHLTER
INNOVATIVER ÖKOLOGISCHER TECHNOLOGIEN
IN EUROPA – ERFOLGE UND ERKENNBARE
FEHLEISTUNGEN**

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Ausgehend von den drei Grundpfeilern der „Nachhaltigen Entwicklung“ – Ökologie : Ökonomie : Soziale Gerechtigkeit – werden die Wechselwirkung zwischen den drei

wesentlichen globalen Herausforderungen, vor denen die Weltbevölkerung steht „Befriedigende Versorgung mit Nahrung“: „Ausreichend Energie für Jedermann“ : „Klima- und Umweltschutz“, das Gleichgewicht zwischen diesen und die gravierenden Folgen bei erheblicher Störung dieses Gleichgewichtes betrachtet und diskutiert. An Hand einiger, bislang bekannter aber auch gänzlich neuartiger Innovationen aus den Bereichen Nahrung, Energie und Umwelt/Klima wird das in der Überschrift genannte Thema abgerundet.

N.V. Kobeleva

DYNAMICS OF ANTHROPOGENIC AND ARTIFICIAL ECOSYSTEMS OF THE SUBARCTIC REGION OF WESTERN SIBERIA

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A subarctic region is a territory characterised by the development of cryogenic ecosystems, permafrost being the leading factor for the formation of their dynamics and structure. The dynamics of these ecosystems is influenced both by natural conditions (spontaneous dynamics) and human economic activities (anthropogenic dynamics). The informational background of this research consists in the materials of remote sensing and field studies conducted by the author.

In the examined region, spontaneous dynamics of changes in cryogenic ecosystems is primarily connected with formation and transformation processes in lake basins, solifluction slope deposits and frost heaving. It was also determined that the speed of dynamic processes increased from the south to the north of the Subarctic region. The spontaneous dynamics of ecosystems with such cryogenic features as permafrost mounds and frost polygons takes place very slowly, i.e. has a large time interval between changes.

In the course of the development of the Subarctic region, sections with various ecosystem types were disturbed. Depending on the type of a cryogenic ecosystem and the intensity of the disturbance, there are different ways of their restoration. Extreme vulnerability and instability of natural systems of the North towards external action determines their instant reaction to any outside interference, the most vivid marker being permafrost relief forms. Studies of such cryogenic morphosculptures as thermokarst, frost polygons or permafrost heaving make it possible to assess the degree of transformation of ecosystem under the influence of anthropogenic factors and forecast future changes.

The restoration dynamics of anthropogenic ecosystems can be expressed in the terms of long-term and short-term production categories. For example, self-recovery of lowland grass bogs takes 5-7 years and can be referred to as a short-term production association. Depending on the microrelief structure, flat mound peat bogs ecosystems

recover within 7-15 years and can be referred to as temporary production associations. Medium mound peat bogs ecosystems, being short-term production associations, recover as secondary ecosystems in the course of 15-20 years, changing the cryogenic microrelief. Large mound peat bogs, when mechanically disturbed, are characterised by thawing of the upper part of ice-rich mounds; the gap width between the mounds increases and secondary ecosystems appear. During peat extraction in peat quarries, the quarry is filled with water and ecosystems are restored by means of heaving, the structure of cryogenic mounds changing due to the formation of an ice core.

Artificial ecosystems are referred to as a long-term production category. The dynamics of artificial ecosystems takes place by means of recovery of secondary cryogenic relief forms. This dynamics is observed both on the territory of the extracted ground and filled-up ground of levelled sections. It is important to note that on the territory on which many meters of the ground were extracted, and which was characterised by primary bog ecosystems (e.g., ridge or polygons), the same microrelief of the cryogenic structure appeared at the first stage of the artificial ecosystems formation, even in case of sandy bed rocks.

To stabilise and restore the life activity of ecosystems, it is not only necessary to plant grass but also to technically fixate sands. Already in the course of 15-20 later this leads to the formation of secondary systems.

Therefore, the recovery of artificial ecosystems of the Subarctic territories in Western Siberia takes place by means of primary restoration of cryogenic relief forms – cryogenic morphosculptures. In the tundra zone, in the case of territories with primary lichen ecosystems, related to as a nominally primary dynamic category, it is necessary to carry out restoration by means of creating artificial morphosculptures which stabilize thermoerosive processes.

The dynamics of anthropogenic ecosystems depends on the humidity parameter (water content) – the higher it is, the higher is the self-recovery speed, i.e. the restoration speed of anthropogenic ecosystems of a standard dynamic category is the highest.

V.A. Kokscharov
N.I. Danilov
S.E. Schtscheklejin

BEITRAG DER URFU ZUR EINFÜHRUNG VON NEUEN ENERGIETECHNOLOGIEN UND ZUR ERHÖHUNG DER ENERGIEEFFIZIENZ

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Es ist üblich, zu den neuen energetischen Technologien erneuerbare Energiequellen zu zählen, die auf Umwandlung der Sonnen- und Windenergie, der Erdwärme und Energie von Meeresströmungen und Wellen in Nutzenergie und -wärme beruhen. Das technische Potential von solchen Energiequellen ist in Russland außerordentlich hoch

und wird in der Höhe von mehr als 4000 t Vergleichsbrennstoff eingeschätzt, was den Gesamtverbrauch von allen Wärme- und Atomkraftwerken um mehr als das Vierfache übersteigt.

Die Arbeiten der Wissenschaftler der UrFU in dieser Richtung sind mit Entwicklung von neuen Systemen der Rohenergieumwandlung in Nutzformen; mit der Entwicklung von Technologien der Integration von irregulärer Energieausbeute in existierende Netze verbunden.

Zur Lösung dieser Aufgaben sind in der UrFU Ausbildungs- und Übungsbereiche mit erneuerbaren Energieerzeugungsanlagen errichtet. Der Hauptbereich der UrFU ist mit Anlagen verschiedener Art ausgerüstet, die Daten werden gesammelt und in das einheitliche Datenverarbeitungszentrum geleitet.

Schnelle Beschaffung von quantitativen Informationen über Klimaverhältnisse (Wind, Sonne, Temperatur, Feuchte u.a.) mit Synchronmessung der Effizienz von Energieanlagen ermöglicht die Optimierung von bestehenden und Verifizierung von neuen Konstruktionen. In der Zeit von 2010 bis 2014 wurden in der UrFU 20 Erfinderpateente für neue Typen der erneuerbaren Energieanlagen.

Die wichtigste Aufgabe bei der Einführung und Nutzung besteht in der Entwicklung von Technologien der Integration von irregulärer Ausbeute der erneuerbaren Energiequellen in bestehende Netze. Dieses Problem wird auf dem Trainingsgelände „Energieeffizientes Haus“ in der Siedlung Rastuschschij im Kreis Belojarsk des Gebiets Swerdlowsk gelöst, wo ständig 8 Familien der Mitarbeiter der Universität wohnen.

Das Objekt hat Windkraftanlagen mit einer Gesamtleistung von 8 kW, Solaranlagen zur Wassererwärmung für Warmwasserversorgung, Photovoltaikanlagen mit Akkumulatoren zur Speicherung der Energie und Systemanlagen mit Synchronisation mit dem öffentlichen Stromnetz.

Zur Erzeugung der Wärmeenergie werden Varianten mit Wärmepumpenanlagen untersucht. Es muß darauf hingewiesen werden, dass der größte Teil der verwendeten Ausrüstungen von Wissenschaftler der Universität entwickelt und im Produktionskombinat der UrFU hergestellt ist.

Dank der langjährigen Erfahrung (über 10 Jahre) mit dem Betrieb der Energieanlagen konnten wir Schemas der optimalen Anbindung der erneuerbaren Energieanlagen an die Strom- und Gasversorgungsnetze ausarbeiten und den Verbrauch von konventionellen Energieressourcen im Objekt wesentlich (um 30-40 %) ohne Lebensqualitätsminderung senken.

Dieses Objekt wird in großem Maßstab verwendet, um die Möglichkeiten der erneuerbaren Energetik zu zeigen und Erfahrungen mit ausländischen Gelehrten auszutauschen.

E.B. Kolbachev

INSTITUTIONAL METHODOLOGY AND METHODS OF NATURAL SCIENCE FOR SOLVING ECOLOGICAL AND ECONOMIC PROBLEMS

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The intensive development and using the natural science methodology for the economy and management become actual nearly thirty years ago. The reason was inadequacy of the traditional explanations of the economic processes and phenomena and the mismatching between the real financial data and the existing economic theories.

The grave shortcomings of the monetary valuation of the innovation processes and innovation projects are the general result of the money units' instability. Therefore, working out the innovation valuation methodology, which is based on the approach of natural sciences, is an actual task, and the objective of the work.

The last two decades was a period, when the development of the innovation institutions theory became an actual and prospective school

Using of the natural science methodology gives a complete result in aggregate with the approaches, presented by the institutional and evolutionary economic theories.

Solving the ecological and economic problems is a field for the prospective using of the natural science methodologies. This field includes both the characterizations of the biological and physicochemical processes and the cost estimation of these processes.

A special place among them is taken by the econophysics – a discipline that exists as a union of researching the securities profitability's dynamics, examining the wealth and gains' dispersion in the society with the help of statistical physics methodology and using the quantum mechanics models to describe the interactions between the economic agents (similarly to the interactions between the elementary particles).

Among other factors, natural science methodologies may be efficient for the solving of the production and other waste management problems. In that case the level of the technological processes' development in the wastes recycling, of the business processes and production systems that develop the processes should be determined by the correlation of the systems' conditions with the features of one or another technological order.

A level of the information's materialization in the production system may be used as a quantitative characteristic of the technological order. Materialization level increases during the transition from the previous order to the next one. Other quantitative characteristics of the technological order are the shaping processes' dimensional scales. As a characteristic is to be considered a scale of the prevailing technology's shaping process, which one is also determines the economic results of the production in general.

In the presented situation a possibility for the practical use of the extremely efficient technology concept exists. Using this kind of technology means that developing a process

with 100% selectivity and maximum possible product outcome should be provided. For getting such result the features of development of the technological processes' economic result should be examined, with the help of the stoichiometry, chemical kinetics and thermodynamics methodology.

Using this approach, worked out by researchers of the South-Russian State Polytechnic University and approved of the economic methodology for complex processes of waste management. They also attempted to ensure a common profitability of this production, by combining highly profitable processes (such as tin recovery from the tinned plate wastes), utilization of aluminum wastes, cooking of the steel cuttings and other processes with knowingly low level of profitability.

It is known by the experience that the methods of natural science and of institutional and evolutionary methodology may be most efficiently studied by students (of economics and management), if teachers use solving of ecological and economic problems as the examples.

Alina Kolovska

ECO-EDUCATIONAL OUTREACH IN MOSCOW

Eco-Educational Platform "The Center of Resources Economy"

Non-profit Organization Coalition "PRO Otkhodi"

Moscow, Russia

The systematic method is needed for forming new ecological-estimated outlook. For achieving this goal in 2012 the ecological-educating platform "The Center of the Resources Economy" (website www.centrecon.ru) was founded with the effort of nonprofit organization Coalition "PRO Otkhodi" with the assistance of volunteers and few socio-estimated companies.

The Center of the resources economy also disposes the problem of environment in practice: it promotes the development of competent use of the waste products. The thing is that the Center has the station of useful receiving of wastes for recycle. Every two weeks about 1.5-2 tons of the wastes such as spoilt paper, plastic, glass, metal, the Tetra Pak are sent from the station of receiving secondary resources to the recycling center. Moreover, there is made the museum "PRO Otkhodi" with the assistance of the Moscow Youth Multifunctional Center, it contains the representation of various recycling Russian factories. In the eco lecture-hall of the museum there are given specially developed course of lectures "The Recycling". Thus the Moscow citizens have the opportunity to familiarize themselves with developing recycling industry and do their part for solving the problem of trash giving their wastes to recycle.

The results of the two-year Center's work in the sphere of environmental education of the Moscow citizens:

More than 580 various informative and volunteering-educational events (lections,

seminars, master classes etc.) have had a place;

5569 adult participants took part in educational events in The Center of the resources economy directly;

16 interactive environmental exercises for children were worked out which were visited by more than 1200 pupils only in 2013-2014.

24095 people has visited educational events of The Center or have been taught distantly (work of the eco lecture-hall, lections by the Internet, the camp "Prosvet", summer camps, away volunteer events).

Within the next few years the priority aim of the Center is environmental education of children because the theme "Modern ecological problems and the ways of their solving" are not almost considered in the Russian school system. Many adult visitors of the Center bring their children to the kids' environmental courses.

The Center of the Resources Economy is opened for cooperation with other organizations; it is searching the partners for the grant projects' realization.

A.N. Konakbaeva

CLASSIFICATION OF COAL WASTE FOR UTILIZATION

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Approximately 90 elements of Mendeleev periodic system were found in solid wastes of mining and coal processing.

But the basic mass of mineral part consists of relatively small number of elements (more than 0,5%). They include: silicium, iron, aluminium, calcium, magnesium, sulfur, titanium, phosphorus, sodium, and potassium. It is necessary to elaborate their classification to use them properly. And also it is required to use in classification basis the minimally desired number of determined indexes which are sufficient for waste distribution to one or another form of consumption. Having analysed waste quality requirements the authors are able to set the necessary minimum of indexes when investigating of waste coal washing, technical analysis, mineral petrographic composition, chemical composition of ash, and mechanical strength. According to these indexes the usefulness of waste coal washing for enterprises of "ArcelorMittal" JSC for different types of using was determined.

Afterwards more complete and wide classification of coal wastes was offered, which includes waste coal washing, coal processing and coal production. On this classification the usefulness of waste for one or another type of consumption is estimated only by litho-mineralogical and chemic-technological characteristics excluding technological tests.

Its usefulness developed in tabular form. Taking this classification and results of waste analysis fore-quoted the classification of waste coal washing of Karaganda field among coal preparation plants and settings was produced, and also applicability for different types of consumption was determined. The data show that wastes of gravity preparation of five coal preparation plants and settings are usable for burning and gasification, and

wastes of six coal preparation plants in natural are usable for agglomerate production. Wastes of ore mining and processing mills of Kostenko Mine, ore mining and processing mills "Saranskaya" and coal production plant No. 1 of "ArcelorMittal" JSC are suitable for this type of using only after decarburization or in the mixture of clay. In addition to these plants in production of ceramics it is required to decarbonize the wastes of gravity preparation of ore mining and processing mills No. 38 for the Mine "50 years of October" and processing plant "Vostochnaya". Waste of ore mining and processing mills No. 37 and No.38 of mine named after 50 years of October and controlled object of mine "Maikidukskaya" are suitable for thermorecovery processes, the wastes of other plants do not meet the requirements of iron content. Wastes of two coal production plants and settings (ore mining and processing mills No. 37 of mine named after 50 years of October and controlled objects of mine "Maikidukskaya") are suitable for production of refractory materials because only this plant meets the requirements on sulfur content.

Wastes of flotation are used less widely. For two types of consumption - burning (gasification) and agglomerate production, the wastes of all plants are appropriate except coal preparation plant "Karagandinskaya", because of high ash content (low content of carbon) in its flotation wastes, which are not appropriate for burning and gasification but are suitable for production of ceramics.

According to the classification in general the waste of coal processing in natural is not suitable for production of expanded-clay aggregate because of high content of carbon, fine ceramics because it doesn't fit the conditions on iron. For production of silicon aluminium alloy it is required to sort the waste out by size, production of rubble due to a predominant content of clay material, production of a glue material in view of high content of carbon. Moreover, the waste is not appropriate for preparation of energy oil because of low content of carbon (high ash) and for production of pyrite because of small content of pyrite.

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TECHNICAL ASPECTS OF MICROWAVE ENERGY USE IN RECYCLING OF SECONDARY ORGANIC RESOURCES

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Fundamental and experimental study of transformation of high-frequency electromagnetic energy in multiphase and heterogeneous environment (secondary plastic materials, hogged wood-room refuse, secondary rubber materials, etc.) provided development of new research-and-engineering and technological solutions for recycling different materials, and methods of microwave energy effect on heating up, pyrolysis, depolymerization of recycled secondary plastic materials, and devulcanization of recycled secondary rubber materials.

Microwave energy use in recycling of carbon bearing materials speeds up and

improves the efficiency of these processes as compared to the traditional ones.

The physical and technological effect of microwave energy on carbon bearing materials is dependent on their micro-and macro-heterogeneity, environmental parameters dynamics for energy consumption, the non-linearity of transformation of microwave energy into thermal energy, structural and polarization characteristics of the electromagnetic field.

The specificity of properties of carbon bearing materials affected by microwave energy requires a combined approach to their heating up and chemical transformation.

For certain processes, adding agents improving interaction of the material with microwave energy is needed.

As a result of fundamental and experimental study of the impact of electromagnetic waves on the dielectric medium, the correlation between the characteristics of microwave electromagnetic fields and carbon bearing materials composition has been identified.

Based on this study, the parametric analysis for experimental equipment providing uniform bulk heating of materials has been carried out; optimal specific power per unit volume for various carbon bearing materials has been identified.

There has been worked out a scheme of carbon bearing materials destruction showing the effect of temperature distribution on chemical reactions, and dependence on the interrelations of electromagnetic and thermal fields. It has been established that the microwave electromagnetic field has both thermal and activation effect on the carbon bearing material.

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CORROSION STABILITY OF PRODUCTION EQUIPMENT

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The paper presents the research results concerning corrosion stability for steel used to manufacture baking equipment. Different ways to increase the service life of the equipment are suggested.

While functioning, the baking equipment is exposed to a high temperature (about 190-220° C), influence of corrosive environment, mechanical loads including impact ones, and wearing-out processes.

Corrosion is one of the main factors reducing the equipment service life. The character of the corrosive effect suggests uniform corrosion. A metallographic analysis of the steel using for the working equipment was made. The microstructure shows that the steel is low-carbonated, with carbon concentration around 0,2%. Although such steel is recommended as heat-resistive for different equipment working under high-temperature conditions, it may lack the sufficient corrosion resistance.

Corrosion tests of carbon steel samples were made to determine the corrosion rate

at a temperature of 200° C – both at the laboratory and in the real baking plant mode. To find the corrosion rate, a gravimetric method was used. The laboratory results show low corrosion stability on a corrosion-resistance scale. The corrosion process in the oxidized atmosphere is characterized by interaction between metal and oxidizing agents penetrating the layer of solid corrosion products. To process the results, known equations of oxidizing process laws were used. The equations connect the formed oxide layer thickness which depends on the reacted metal quantity, with the oxidizing duration. It was found out that the oxide layer growth was in accordance with a parabolic law. This fact shows that the layers do not have protective properties.

When testing in the real production conditions of the baking plant, the samples were placed directly in the rotation type oven during the baking process. It was found out that in this case, the corrosion rate was almost two times as low as that got at the laboratory. The reasons can be organic substances formed in the oven during the baking process and acting as corrosion inhibitors, as well as reduction gases – carbon oxide, for example. Besides, the baking technology has a stage when hot water vapor is supplied into the baking camera. This can create an oxide layer with higher protective properties – similar to oxidizing in overheated water vapor. All these can slow down the corrosion process.

There are different ways to reduce corrosion waste. However, there are certain limitations due to the peculiarities of food industry. For instance, powerful drawing makes the treatment of the oven baking space with corrosion inhibitors ineffective. Besides, a lot of chemical substances used as corrosion inhibitors can be toxic. Not all protective coats slowing down corrosion can work under high temperature, humidity and mechanical influences including shock loads and wearing. And these protective coats have to provide food safety.

One of reliable ways to reduce corrosion waste is to change carbon steel to a more corrosion-stable material. The research included a corrosion test of high-alloy chromium-nickel steel made in the real production conditions of the baking plant. The results show quite a high degree of the steel corrosion stability.

Undoubtedly, high-alloy chromium-nickel austenite steels are expensive. But they have high corrosion resistance and ability to withstand heat. These steels have good technological properties and welding capacity. This is very important for the equipment manufacturing purpose. Plastic deformation causes a significant strength increase of austenite steels. This complex of properties corresponds to the performance of alloys used for food industry equipment working in the above mentioned conditions.

The economical calculations prove the rationality of such changing. Another reason is ecological considerations, as the use of up-to-date equipment manufactured from corrosion-stable steels reduces environmental pollution.

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L.M. Makalskiy
L.M. Musharatskiy

PHYSICAL METHODS OF AGRICULTURAL WASTE MANAGEMENT

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Waste and waste treatment of agricultural materials, processing of animal products and waste management from treatment of animal hair have an impact on the environment, and their removal, storage and utilisation do not always correspond to safe life activity conditions of rural and urban population. Waste incineration and its direct utilisation lead to air, water and soil pollution and to a decrease in the quality of the environment.

The use of physical methods of waste management and generation of combustible waste and composites by using special treatment and adding binding components as well as cavitation processing of agricultural waste makes it possible to obtain solid composites with high caloric value, improved characteristics in flue gas emission and reduced environmental stress.

This article presents generating processes of combustible components and preparation of pellets to obtain power resources in form of pellets and flammable liquids.

Waste from agricultural raw material treatment and agricultural product plants as well as food industry and energy treatment have an impact on the environment and life activity of population. Environmental pollution due to waste, emissions and wastewater has its effect on all areas of human activity and acquires global character, thus creating a possibility of an environmental disaster. The whole biosphere is contaminated by an increasing amount of solid waste, gas emissions and wastewater. In addition to pollution coming from food industry, housing and utility and energy sector, a negative impact on the environment is also caused by automotive industry, metallurgy, engineering, pulp, paper and board, woodworking and mining industries as well as pharmaceutical, medical and chemical industries etc. with hazardous wastes.

An individual's chemical load in Russia during his/her lifetime already exceeds the following values:

Hydrocarbons	CO	Pesticides	Fluorides	Phenol	Lead	Mercury	Heavy metals
2-8 t	2-4 t	140 kg	6.3kg	2.1kg	1kg	12g	1kg

Agricultural waste is fully responsible for the life quality of people, because it does not only contain waste from crop production, but also from livestock production, poultry and food industry. Agricultural waste cannot always be used as fertilizer; it is necessary to process and disinfect it. Agricultural waste in its concentrated form does not

contribute to cultivation of new plants. Agricultural waste includes, for example, tops of solanaceous plants (potato, tomato) and waste from livestock and poultry production with decomposition-resistant bones, down and feathers and unpleasant smells.

Incineration of waste from agricultural treatment and processing also meets great difficulties due to a high content of moisture. In this area, there are new techniques of agricultural waste management which transform waste into fuel of high caloric value. These techniques include the application of such physical methods as an increase of pressure and temperature, changes in gradients and physical shock.

In order to process waste for a later incineration, it is necessary to prepare water which is able to dissolve and neutralise waste for its further intense cavitation processing until it is finally pressed into pellets.

This industrial water has to be a good solvent, i.e. not to contain salt and oxidant excess during the incineration and serve as a structure for mixing and carrying out cavitation in a suspension or organized compounds. Sometimes it has to include substances – lignins - not suited for living beings. In order to improve the caloric value of the fuel, the mixture receives some organic compounds, peat, oil products, lignins and solid domestic waste.

A.V. Kosarev
N.V. Vedeneeva
E.I. Tikhomirova

MATHEMATICAL MODEL OF FILTER SYSTEM BASED ON POLYMER MATRIX

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Calculation of adsorption capacity of substances that are used in water purification, is an important challenge for the manufacturers of these products. We have developed a mathematical model to change the bactericidal effectiveness of the solution filtered through adsorption system based on modified polymer-anion. The polymer is associated with ion exchange resin, shows antibacterial activity. In the case of small volume samples download has been proven effective against *Escherichia coli*. However, experimentally evaluate the sorption capacity of polymer relative to bacteria was hard enough.

We made a mathematical model to solve this problem. The filtering process, which is being carried out under static conditions, can be represented as follows. Specific bactericidal activity is defined as:

$$B = \frac{dN}{dm} \quad (1)$$

where N is the number of bacteria in the original solution, the KOE/ml; m is the mass of the adsorbent. The dependence of the specific polymer depends on the number of bactericidal activity of bacteria in the original solution describes us power function:

$$B = k_s N^{-n} \quad (2)$$

where N is the number of bacteria in the original solution, the KOE/ml; k_s -coefficient characterizing the bactericidal effectiveness of modified polymer adsorbent; n -coefficient characterizing the intensity of this process.

We have also received a mathematical model of the filtering process, implemented in dynamic conditions. Filter the solution containing the bacterial culture, leads to interaction of bacteria with the active centers of the polymer system. This leads to a decrease in the concentration of bacterial culture in the solution. Bactericidal activity of polymer in this case is presented as a power function of the flow rate. It can define the parameters of the intensity and effectiveness of bactericidal action of polymer based on this model. Rate constant of this process is a factor in its effectiveness, and the power indicator is a factor intensity.

Decrease the bactericidal effectiveness of polymeric matrix during its interaction with a bacterial culture, can be written as follows:

$$\frac{dB}{dv} = -k_d v^2 \quad (3)$$

where v - velocity of filtration. The solution to the equation (3) in a linearized form can be represented as:

$$-\ln \Delta B = \ln \frac{k_d}{3} + 3 \ln v \quad (4)$$

Thus, linearization of experimental function of the bactericidal effectiveness B from the filtration velocity v can be held at coordinates $-\ln \Delta B$ vs $\ln v$. The k_d value can be determined from the value of the vertical cutoff this linear relationship, the B_0 value is defined in the experiment for static conditions. This model describes how to change the filter in a bactericidal activity at low speeds of filtration.

The work is relevant to the decision of environmental problems associated with biological purification of drinking water.

A.V. Kosarev
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MATHEMATICAL MODELLING OF HEAVY METALS ADSORPTION ON ORGANO Bentonite

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The problem of water purification from heavy metal pollution is currently relevant. Adsorption is one of the most effective methods of solving this problem. Zeolite systems particularly bentonite are most common on the adsorbents. However,

the problems of improving the effectiveness of adsorption purification is relevant. We have developed an approach aimed at increasing the performance of adsorption processes. It is based on a mathematical modeling of heavy metals (Pb^{2+} , Cd^{2+} , Co^{2+}) adsorption on organobentonite. Adsorption process we used in Langmuir, Freundlich and Brunauer-Emmett-Teller (B.E.T.) approaches. The first of these approaches is based on the assumption that all active centers of homogeneous surface of the adsorbent are of equal energy of adsorption. The adsorbed molecules form a monomolecular layer on the surface of the adsorbent. Freundlich model assumes inhomogeneous distribution adsorption centers. Heavy metal ions will populate the surface of the adsorbent, forming the mixed layers. Brunauer-Emmett-Teller approach is based on the assumption that the metal ions form polymolecular layers on the adsorbent surface. We have performed experiments on the adsorption of Pb^{2+} , Cd^{2+} , Co^{2+} ions on organobentonite.

Table 1. The results of the experiment, processed in the framework of the above models are presented in the table (for, Cd^{2+} , Pb^{2+} ions).

Cd^{2+}				
Type of isotherm	Parameters of the isotherms		R^2	A linear regression equation
	Intensity	Efficiency		
Langmuir	$K_L = 39,67$	$\Gamma_\infty = 0,0024$	0,9603	$y = 7,361x + 287,89$
Freundlich	$n = 142,86$	$K_F = 293,765$	0,8909	$y = 0,007x + 2,465$
B.E.T.	$K_{BET} = 1,029$	$\Gamma_\infty = 0,0027$	0,8947	$y = 10,444x + 360,95$
Pb^{2+}				
Type of isotherm	Parameters of the isotherms		R^2	A linear regression equation
	Intensity	Efficiency		
Langmuir	$K_L = 31,72$	$\Gamma_\infty = 0,0019$	0,8431	$y = 8,984x + 280,98$
Freundlich	$n = 100$	$K_F = 288,403$	0,8333	$y = 0,01x + 2,455$
B.E.T.	$K_{BET} = 0,0045$	$\Gamma_\infty = 0,0304$	0,7003	$y = 0,147x + 32,67$

As the table 1 shows, the greatest weight in the modeling of adsorption isotherm Langmuir belongs. Adsorption isotherm analysis showed that the most likely mechanism of adsorption of heavy metal ions on organobentonite is a mixed formation of adsorbent-adsorbate layers with a predominance of single-molecule layers. It should also be noted that the organobentonite sorption capacity exceeds this figure by zeolites about the order. Therefore, this material is a promising adsorbent in wastewater treatment of heavy metal ions.

A.V. Koshelev
E.I. Tikhomirova
V.A.Zamatyrina
E.S.Troyanovskya

**DEVELOPMENT OF A FULL TECHNOLOGICAL CYCLE
OF HUMIC COMPOSITIONS PRODUCTION
FOR REMEDIATION OF CONTAMINATED AREAS**

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In the past five years, we had done research work on the development of formulations and manufacturing of high-performance environmentally safe product for remediation of soils contaminated with heavy metals, arsenic, organic toxicants, petroleum products. The basis for such compositions were salts of humic acid (humates) which are oligomers of aromatic acids.

Humates consist of hydrophobic aromatic skeleton and rich functional groups of the carbohydrate-peptide hydrophilic periphery.

Humic substances are multifunctional polyelectrolytes (polyampholytes). Humates contain positively charged functional groups (amines, imines, peptide) or negatively charged (alcohol, phenol, aldehyde, ketone, carboxyl, methoxyl, etc.). These groups define the tread features of humates in the biosphere. Tying in ecotoxicants complexes, humates reduce their bioavailability.

The raw material for humates is peat, lignite, sapropel. The maximum concentration of humates on the standard technology of high-temperature alkaline hydrolysis, 30-50 g / l and the cost of production is about 2 euros per liter. Such technical and economic performance is unacceptable for large-scale detoxification works on vast areas.

We have developed a technology for producing highly concentrated solutions of humates (up to 400 g / l) of an oxidized lignite ultrasonic field at atmospheric pressure and room temperature. The laboratory setup consists of a module ultrasonic reactor with capacity of 1.7 liters and a generator.

The module is made of stainless steel with a seating on the outer surface of the vibrational element. Power is 1.6 kW, the frequency is 22 KHz. Production Cost is less than 0.5 euro per liter of concentrate.

Completed model experiments showed that soil detoxification by binding heavy metal ions, adsorption and neutralization of organic toxicants occurs within a few hours after application of humates and watering the soil.

The process of increasing the buffer capacity of soil, including increasing its moisture capacity, the formation of the optimal structure, optimum soil absorbing complex of natural soil microbiocenosis ranges from two weeks to two months.

Wind erosion (dusting of ground) stops immediately after introduction of humic compositions and soil irrigation with water. The chemical mechanism of detoxification of soil is in the interaction of metal ions with humic acids to form water-insoluble complexes.

Physical-chemical basis of the interaction of humic acid with heavy metal ions and organic compounds include the simultaneous occurrence of ion exchange, adsorption and absorption along with occlusion providing effective sanitation (detoxification) of soils.

Olena Kotsar
Sergij Batchuk
Julia Antikova

**ECOLOGICAL, TECHNOLOGICAL AND ECONOMICAL ASPECTS
OF RESOURCE-SAVING TECHNOLOGIES FOR CONDITIONING
OF RETURN WATERS AND SLUDGE**

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Solution of the issues, associated with preservation of life environment and human life conditions much depends on the state of natural resources, main of which are fresh water and fertile soils.

This work represents ecological approaches to implementation of optimal engineering solutions in construction and modernization of waste water treatment plants at objects of water use, including industrial, agricultural and municipal companies.

Technologies, aimed at reduction of concentration of pollutants, controlled by 20-25 indexes, to normal values, are used in order ensure treatment of return waters, drained into surface ponds or underground hydroecological reservoirs. Cost price of return water treatment fluctuates within the range from EUR 0.5 to 2.0 per cubic meter of return water.

However, quality of treated return waters is not completely recovered before their discharge into ponds, used for fish breeding, recreation and water supply. Moreover, discharge of WWTP treated return waters into the sea and limans results in irrevocable losses of fresh water, world reserves of which reduce constantly.

A real method for protection of water resources from depletion and pollution is a development and implementation of flow diagrams of portable and technical water supply. Moreover, it is useful to use conditioned return waters in technical water supply systems.

Conditioning process, i.e. treatment of sewages that ensures technical availability of sewages and also sanitary-and-epidemiological safety of reused fresh waters for technical purposes, is ensured through use of less powerful and simpler apparatuses, installed on smaller areas. This saves fresh water and reduces maintenance costs of water carriage systems, prevents ecological damage from pollution of fresh waters and depletion of their natural reserves.

In most cases in order to reach necessary condition of technical return water it is enough to remove suspended matters and admixtures of colloidal dispersion, stabilize it (prevent corrosion activity and deposition of salts in technical water supply systems) and ensure their sanitary and epidemiological safety.

Conditioning of return waters for technical needs is by 35-40% cheaper than their treatment for discharge into ponds. Savings of area for construction of return water conditioning plants are equal to 55-70%. Cost of technical return water conditioning varies within EUR 0.3-1.5.

The use of return water and sludge at enterprise reduces fresh ground water extraction in technological processes by 25-30%, discharge of return water into ponds, operation costs for water carriage system and makes it environmentally safe.

Conditioning of return water sludge, generated in polluted water treatment processes with use of low energy-consuming apparatuses such as screw dehydrators before use of biotechnologies allows utilization of obtained biohumus in order to increase soil fertility and improve its structural-and-chemical properties.

Plants for conditioning of reused water in service water systems with utilization of sludge are successfully operated in wineries, thermal power plants, milk plants, meat-packing plants and other facilities in Ukraine, Russia and Belorussia.

A.B. Kubaev
B.G. Kultanov
Z.B. Tauesheva

INTEGRATED EFFECT OF ECOTOXICANTS ON THE DEVELOPMENT OF THYROID PATHOLOGY AMONG POPULATION IN THE ARAL SEA REGION

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Thematic justification. The Aral Sea environmental health crisis is recognised as one of the most global problems of today. The water level in the Aral Sea is continually dropping, the Syr Darya is becoming more and more shallow. By 2000, more than a half of 1.5 million ha of soil dried, salinised and desertified. Taking into consideration the dry climate and constant wind typical for this region, there is a formation of dust and salt aerosols leading to health problems. In addition to that, the territory has been chemically contaminated for decades by high doses of pesticides, herbicides and heavy metals which also have a negative effect on health, in particular, the thyroid function.

Materials and methods of the research. We examined the population of the settlement Aitek-Be and Zhusalı in the Kyzylorda region. The inclusion criteria were: to live in the Aral Sea region for at least 5 years and to have a profession the occupational hazard in which does not exceed Category II. All experimental subjects underwent a clinical examination and laboratory tests (determination of TSH level and free thyroxine (T4) in blood serum). The statistical data analysis was carried out by means of STATISTICA 6.0 (Stat-Soft, 2001) and software BIOSTATISTICA 4.03.

Results. High level of subclinical hypothyroidism among men was determined in all the examined regions, more specifically, in the Aitek-Be settlement – 21 cases (12.65%), with mean values of TSH – 6.16 ± 0.84 and T4 – 13.26 ± 0.44 ; in the Zhusalı settlement – 35 cases (23.97%), mean value of TSH – 4.93 ± 0.33 and T4 – 14.05 ± 0.57 . It is important to mention high abundance of subclinical hypothyroidism among women. Thus, in the Aitek-Be settlement there were 45 cases (15.41%) among women, with mean value of TSH – 5.68 ± 0.41 and that of T4 – 12.42 ± 0.24 ; in the Zhusalı settlement – 33 cases (17.64%), with mean values of TSH – 5.14 ± 0.49 and T4 – 13.25 ± 0.56 .

We were also able to determine profound disorders of the thyroid function, with clinical symptomatic hypothyroidism and laboratory confirmation of a decrease in the

free thyroxine level and a simultaneous increase of the thyroid stimulating hormone (TSH) in the blood serum, more specifically, in Aitek-Be - 3 cases (1.8%); mean value of TSH – 4.83 ± 0.12 and that of T4 – 8.89 ± 0.41 and in Zhusaly - 6 cases (4.1%), mean values of TSH – 7.37 ± 1.75 and T4 – 7.68 ± 0.92 .

The recorded data for women with the given pathology is as follows: in Aitek-Be - 27 cases (9.24%), mean values of TSH – 9.80 ± 1.82 and T4 – 8.03 ± 0.43 and in Zhusaly - 14 cases (7.48%), mean values of TSH – 9.85 ± 1.90 and T4 – 14.68 ± 6.70 .

Conclusion. We were able to determine that the prevalence rate of subclinical and symptomatic hypothyroidism in the examined men and women was significantly higher than the average prevalence of these pathologies in the population. It allows us to make a conclusion that high prevalence of the thyroid function disorder among the population in the Aral Sea region is caused by the negative effect of ecotoxants prevalent in the region.

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WATER AND SEWAGE WATER CONDITIONING USING CAVITATION TECHNOLOGY

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In the context of fresh water deficiency it is critically important to improve the existing and develop new methods of water conditioning. One of the promising methods of water conditioning (desalinisation) is the use of a supercavitation evaporator. The evaporation process in the machines of the supercavitation type takes place due to the creation of the developed cavitation flow during the flow of the underheated liquid around the cavitator, with the subsequent steam extraction from the formed cavities. High heat exchange intensity, in comparison to other methods of steam generation, is explained by the distinctive features of the evaporation process from the cavity surface. During supercavitation, high temperature and velocity gradients between water and steam maintain quick evaporation. The cavity is created due to hydrodynamic factors, i.e. an increase in local flow velocities around the cavitator, that is why the pressure in the cavity is significantly lower than that of the circumambient liquid. Supercavitation evaporation is characterised by a series of additional effects: difference in temperatures due to hydrodynamic differential pressure, difference in partial water steam pressure in the liquid and the cavity etc. The phase interface only lets water steam and dissolved gases inside of the supercavity.

In order to simulate working procedures of the supercavitation evaporator, we used a model of a two-phase homogenous flow, which is based on the assumption of the local

kinematic and thermodynamic balance between the phases and absence of the interface between steam and water. We also ignored the heat release due to viscous friction, the temperature pattern being defined only by evaporation and condensation. The supercavitating liquid flow in this case is described by continuity equations, conservation of angular momentum, equation of energy conservation and a liquid phase transition equation presented in the stationary form. The numerical solution of the problem was carried out by means of the control volume approach using the programme ANSYS CFX. We analysed patterns of running and rotary supercavitation evaporators.

The results of the numerical experiment were as follows: the phase transition zone of the steam volume ratio in the mixture flow has a rather thin interface, which is explained by high pressure gradients in this area. The effective cavity length for the given conditions was 12 mm. The temperature inside the cavity in comparison to the entry to the working section decreased by approx. 38 °C and increased by 24 °C in the cavity closure region. This effect can be explained by a pressure increase in the tail part of the cavity and the swirl: in the closure region there is a rather high heat generation due to the steam condensation, which is the reason for the temperature growth in this area. According to the results of the calculation, the given steam extraction from the cavity does not lead to the destruction of the cavity, which is explained by an intensive evaporation on its surface and stable interface dynamics.

The analysis of dependence of cavitation number from temperature showed that a decrease in temperature led to a decrease of cavitation intensity in the water flow. The influence of thermodynamic effects increases with a temperature increase of water which comes to the working section of the supercavitating evaporator and with an increase in steam extraction from the cavity.

The developed mathematical model makes it possible to carry out calculation studies of cavitation flows, taking into consideration thermodynamic effects. We carried out stimulation of working procedures in the supercavitation evaporator. The obtained calculation results are consistent with experimental data.

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INDUSTRIAL AND TOP PRIORITY WASTE MANAGEMENT

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As a rule, power industry waste has a high potential risk for the environment and human health. However, our society does not fully realise this risk and treats endless ash disposal areas and nuclear power plants dealing with radioactive waste management within large city limits with patience.

The largest advantage of the nuclear power engineering is the enormous concentration of energy in the fuel, which is approximately 2 million times higher than in the fossil fuel. For

this reason, in terms of power economy, both the volume of the fuel itself – a truck instead of hundreds of trains – and the volume of the final waste after its treatment are insignificant. The former president of the American Nuclear Society Alan Walter has calculated the total volume of the created and compacted high activity waste per American per 70 years of life, if the whole power engineering sector in the US would become nuclear and spent nuclear fuel (SNF) would be treated and recycled. The calculated volume was approximately 300 cubic centimetres. In comparison to that, toxic chemical, fuel and technological industrial waste in the developed countries is measured in hundreds of cubic metres per person.

On the other hand, the problem of waste management from nuclear fuel cycle companies exists at all stages of power generation, starting from the extraction on the uranium ore and ending with SNF treatment. The largest amount of waste is created at the final stage of processing nuclear fuel components. Each country has its own methods of liquid waste recovery in its radiochemical plants, but in spite of the diversity of chemical methods, one of them is applied in every company. This method is called PUREX. The main disadvantage of this method is the use of large volumes of liquid, which at the final stage of the spent nuclear fuel treatment turns into liquid radioactive waste normally kept in special storage tanks. The storage tanks in the US are of a large diameter and small height (approx. ratio of 2.5:1) and are coated by carbon steel; those in Russia are of a relatively small diameter and considerable height (approx. ratio of 1:2.5) and are coated by stainless steel and are able to resist the impact of chemical reagents.

Long-term storage of high-activity liquid waste leads to the formation of a solid sediment compressed to such a degree that due to heat-generating radionuclides the temperature of individual layers increases up to 130 °C. Furthermore, nowadays slurry has a rather high level of radioactivity and heterogeneous composition. The structural integrity of tens of old metal storage tanks raises concern. At present, storage tanks contain a large amount of slurry which needs to be purified and transferred into a solid state for its further disposal. The modern technology of the slurry extraction is based on chemical processes of the sediment dissolution. This method is characterised by an uneven extraction of the slurry components and the formation of a layer with marginally soluble compounds, which makes the sediment treatment considerably more difficult.

It is obvious that the chemical method of the solid sediment extraction has fully exhausted its potential. It is necessary to use a principally new extraction method, because a further impact increase of chemical reagents can lead to the corrosion of the storage tank coating, which is inadmissible from the environmental point of view. Studies carried out at the Siberian Federal University showed promising methods of solid sediment extraction based on cavitation nanotechnology based on hydrodynamic cavitation effects, by means of which it is possible to obtain water, water solution and mixtures with unusual physical and chemical properties, increased solvent power etc. The application of these effects provided the basis for an effective method of solid sediment extraction from storage tanks with liquid radioactive waste.

The new method which uses the cavitation-activated water after the solution of the

sediments made it possible to obtain a suspension which consisted of homogenous slurry microcomponents, which minimises the formation risk of a marginally soluble layer. The application of chemical reagents prepared on the basis on the cavitation-activated water allowed to dissolve slurry components almost fully, without an increase of the corrosion load on the constructive elements of the storage tanks. The suggested method can be effectively introduced for the treatment and recovery of difficult-soluble waste from other companies of the energy sector, e.g. sludge from CHP, TPP etc.

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COUNTERACTION METHODS AND THE TECHNICAL EQUIPMENT OF AN ASTEROID HAZARD

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Asteroid and comet hazard is recognized by the international community as a real threat for the civilization, that requires attention, continuous monitoring of potentially dangerous objects and analysis of possible countermeasures. According to the NASA, a small asteroid hitting the Earth is able to initiate the colossal disasters and, moreover, disappearing of life on the planet. Besides, smaller asteroids can cause a high level of the seismic activity, significant dustiness of atmosphere and a phenomenon similar to a nuclear winter.

At present, the following counteraction methods of destruction or deflection an asteroid are considered.

- Explosion. It is a trajectory impact on an asteroid in order to deviate it from a pernicious position. However, there is a serious risk that the Explosion just splits the asteroid into smaller fragments, which still flock to the Earth. To deflect an asteroid away from Earth explosion ought to be done at a distance from it, therefore the asteroid still keeps its shape. The advantage of this approach is that the suitable technologic solutions for the asteroid problem already exist and can be used, however, the tests of powerful nuclear weapons and displays them in space are limited by international agreements.
- Dust cloud. It is an alternative way to take advantage of using asteroid's kinetic energy for its destruction. Towards the asteroid an artificial formation of small dust particles is created, which will interact with the asteroid surface, forming craters with the mass ejection. As a result - dangerous object will be destroyed.
- Using lasers. It is possible to affect the asteroid by extremely high power lasers. The idea is to direct a laser beam on the asteroid surface; matter begins to evaporate, creating a flow of the gas that as a kind of a jet engine slowly and surely affects the trajectory of the asteroid.
- Using the principles of the solar sail movement. A spacecraft docks to the asteroid and breaks out the solar sail on it. Thus, this asteroid gets an additional acceleration

and changes the direction of the motion. At the same physical principle a proposal of using the surface of the asteroid as a reflective surface is based. Variation the asteroid's reflectivity is assumed to be sufficient to deflect an asteroid from a dangerous trajectory.

- The European Space Agency offers to land a spacecraft on the asteroid's surface – space tug that changes the trajectory of the cosmic body due to its own propulsion force. However, there are insufficiently developed methods of automatic final approaches and landing spacecraft on small space bodies at present.

The most effective and the most dangerous method to destroy the asteroid at the same time is the asteroid destruction by nuclear explosion. Installing the jet engine on the asteroid is safe, but requires too much time to deflect the trajectory. Disposed asteroid orbit using the space-tug (due to the engines, attraction, laser beam or solar sail) requires the punctual spacecraft launch of the high-powered supply capacity. The problem is that modern astronautic is poorly prepared for the speed-launches. Currently, the centre of the asteroid hazard counteractions has been established in SSAU. The main goal of this centre is to create high-performance tracking systems for space-based potentially hazardous objects (PHO).

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DEVELOPMENT OF OILY WASTE TREATMENT TECHNOLOGY

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Oily waste which is being produced in the course of oil production, processing, transportation and further use of oil products is a subject to obligatory disposal. A penalty of up to \$13,000 shall be paid by any enterprise for non-compliance with the terms and conditions of ecological safety according to "the Law on Environmental Protection of the Russian Federation". Therefore the oil-extracting companies quite often fall back on the cheapest ways of oily waste treatment. Oil spill on soils and ground is the key problem of environmental pollution by oily waste on the territory of the Russian Federation. The oil-contaminated soil (OCS) must be disposed or recovered according to ambient quality standard.

On the basis of key ways of oily waste treatment in Russia which has been described in the article and on the example of oil-contaminated soil (OCS) treatment there can be considered two most widespread technologies: bioremediation and thermal recovery. Process of bioremediation is based on intensification of natural decomposition of hydrocarbons by introduction of mineral and organic fertilizers as well as biological preparations obtained from the natural flora of the polluted and being decontaminated soil. Oily waste thermal recovery is produced with the use special-purpose equipment. There is a wide range of such equipment with various design and technological principles not all of which however can provide effective recovery. Most of them have unfairly difficult design and impossibility to use returnable warm of pyrolysis gases that leads to raw material losses and the increased power consumption, low level of OCS purification due to uneven temperature distribution

on the retort surface directly contacting to treated waste.

We developed the process flow sheet of the equipment (UT-2S) for industrial oily wastes treatment on the basis of high temperature air tight decomposition of oily waste. The method of thermal decomposition is based on pyrolysis - destruction of organic part of waste as oil slime at a temperature of 500-550 °C with fixed residue and combustible gas. The equipment is executed from separated functional modules (unit) that provide the maximal density of configuration and access to devices for its service and repair.

The problem of oily soils treatment is actual for the lack of uniform measures for ensuring ecological safety. We have also worked out criteria of prime cost, OCS treatment period as well as OCS purification efficiency and industrial emission of harmful substances of each technology of oily waste treatment with the aim of its comparison. Purification efficiency is accepted as the relation of initial contamination level of OCS (before purification) to final (after purification). Quantitative chemical analysis (QCA) of samples from various working zones of waste disposal landfill is used for definition of purification efficiency of soil. Cost of OCS treatment is defined by the relation of full expenses for each way of treatment to the amount of utilized soil. Quantitative chemical analysis of industrial emissions is carried out by means of the "Expert" gas analyzer for performance evaluation of industrial emissions into the atmosphere at OCS treatment.

The analysis of the results received during this work makes possible to find out advantages and disadvantages of OCS recycling technologies and to evaluate efficiency of each technology.

The technology of thermal recovery by means of the suggested equipment represents the highest efficiency on a number of criteria. And despite the troubles of considerable investments thermal recovery appears to be the most profitable for a wide range of waste treatments, including the asphaltic resinous paraffin deposits after wells repair.

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MONITORING AND RISK ASSESMENT OF BIOLOGICAL INVASIONS ON THE EXAMPLE OF THE IRKUTSK URBAN AGGLOMERATION

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Alongside with the technogenic pollution of the urbanised territories it is possible to notice changes of the biogenic character caused by the introduction of species of living organisms which did not inhabit the ecosystems earlier and were brought by men. Our report does not claim to be exhaustive and embrace all invasive species, it characterises changes in the species composition of phanerophytes and commercially exploited animals. The Irkutsk urban agglomeration (the city of Irkutsk with satellite towns of Angarsk, Usolie-Sibirskoe and Shelekhov) has a tendency to expand. A distinctive characteristic of the agglomeration

is its more extensive expansion in the direction of the Lake Baikal and settlement Listvianka next to the riverhead of the Angara. The mean value of the trend between the 1970s and 2010s makes approx. 0.25 km. Moreover, the existing settlements expand and the number and area of allotments for horticultural associations and other objects of residential and recreation character increase alongside the Baikal highway. The facts mentioned above influence the spreading of invasive species.

The main edificators, dominants and producers of any forest ecosystem are woody plants (trees, shrubs or lianas) and semi-woody plants (subshrubs). They are called phanerophytes according to the Raunkiaer's life-form system and identify the phytocenosis at the species level. We link the degree of the anthropogenic transformation of the phanerophytic flora with the appearance of invasive species from among ergasiophygophytes (term introduced by A. Tellung). The latter are defined as species which were first introduced as cultivated, went through acclimatisation and began to settle independently. The largest part of these species is ornithochoric. They settle in secondary habitats created by men, e.g. road verges, waste areas, embankments etc. For the first time for the region under consideration we have observed the intrusion of ergasiophygophytes into an undergrowth of suburban forests of different degree of malfunction, predominantly along riverbeds and banks of the Irkutsk storage basin with a high concentration of species of frugivorous birds such as azure-winged magpie (*Cyanapica cyana* Pallas), other birds from the Corvidae family (Corvidae), thrushes (*Turdus*) and waxwings (*Bombycilla garrulous* L.). Ergasiophygophytes make up 9% from the total number of phanerophytes of the region and include 13 species from 7 families: Ulmaceae: *Ulmus pumila* L., Grossulariaceae: *Grossularia reclinatum* L., *Ribes diacantha* Pall., *Ribes pulchellum* Turcz.; Rosaceae: *Amelanchier spicata* (Lam.) K. Koch, *Cerasus fruticosa* Pall., *Cerasus tomentosa* (Thunb.) Wall., *Cotoneaster lucidus* Schlecht., *Crataegus maximowiczii* Schneid; Aceraceae: *Acer negundo* L.; Elaeagnaceae: *Elaeagnus argentea* Pursh, Caprifoliaceae: *Lonicera tatarica* L., Rhamnaceae: *Rhamnus cathartica* L. In our opinion, the intrusion of undergrowth species into ecosystems is not particularly dangerous. At the same time, the probability of *Acer negundo* L. appearance in the forest stand does not seem desirable, considering the experience of the European part of Russia and its more western territories.

Indigenous species of ungulates, e.g. roe (*Capreolus pygargus* L. 1758), elk (*Alces alces* L. 1758) and red deer (*Cervus elaphus* L. 1758) do not live close to the city limits. However, even today there are cases of their irregular visits into towns. At the same time, since the 1970s, there has been a tendency in the opposite direction, i.e. immigration of invasive semiaquatic species of mink (*Neovison vison* Schreber. 1777) and musk beaver (*Ondatra zibethicus* L., 1766) to residential areas, which became naturalised both within the city limits and on the surrounding territories. The reason for this was a favourable living environment, i.e. the rivers Angara, Irkut, Ushakovka and Kai together with their valleys and the Irkutsk water storage basin. The presence of these species on the territory of the urban agglomeration means a contamination hazard by infectious diseases transmitted by them, above all, by tularemia. At the same time, if the number of these species is low, the risk rapidly decreases.

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APPLICATION OF HIGH COPYRIGHT LAW AND PATENT LAW TECHNOLOGIES FOR PROTECTION OF CREATIVE ACHIEVEMENTS OF ECO-INNOVATIONS

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High copyright law and patent law technologies (further correspondingly HCLT and HPLT)

are developed and used by specialists and inventors, particularly for protection of creative achievements and innovative ecological business in order to enforce legal protection as compared with their simple conventional invention description. The application of HCLT and HPLT enables to improve protection of intellectual property, to increase significantly their commercial cost, and to prevent competitors from infringing the patent. Application of HCLT is also aimed at overcoming the major disadvantage of the copyright, which only protects from literal copying and which is not effective against counterfeiters or unscrupulous competitors who try to conceal copyright infringements while adding an insignificant creative amendment to the original work of authorship, and pretending of creating an independent work. It should be noted that HCLT and HPLT have not only supporters but also opponents especially among those who “suffered from them” or those who failed to use effectively their possibilities and advantages.

Among practically used HCLT methods and tools, it is noteworthy to mention, for example, providing an intellectual property protection document for a concrete result of the intellectual activity and including in the protection package of at least three additional summarizing objects of the intellectual property law. These are formulas of the author’s conception; the register of important attributes and a scenario planning for variants of the practical implementation of the protected initial result. Most technically complicated formula of creation, however, predominates the largest extent of the protected rights, the formula of the author’s conception as the rule consists of the essence of basic creative statements that were realised by the author in his work, creative characteristics of the author, description of the author’s style and the mode of creation etc. Conflict situations demonstrated the effectivity of the intellectual property protection among the authors who used HCRT by applying for a patent.

While using HPT their methods and tools often bear a subjective-creative character, which complicates their description, and only illustrative demonstration of the final results is effective for understanding. It is similar as in such creative disciplines as Prêt-à-Porter, art music, Haute cuisine. etc. However, there are also objective-creative methods and tools, successfully used by numerous specialists such as the widely known theory of inventive problem solving (TIPS) developed by Genrich Altshuller. It is possible to use it for the tasks of HPT ultimately upgrading it up to the level of Theory of Patenting of Innovative Solutions. However, the latter unlike TIPS is not aimed at casting away, as unnecessary, plenty of modifications on the way to choosing the optimal one and applying for a patent.

Moreover, it encourages an additional search with the use of TIPS of all possible variants of inventive solutions, analysis of similar significant features and creation of accumulative definitions, which will be reflected in the formula of invention and its submission as a patent application. Thus the patent, as the rule, protects all possible variants and modifications and even the possibility of upgrading of the patented object meanwhile excluding the possibilities of granting competing patents.

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ADMINISTRATIVE OFFENCES IN THE SPHERE OF ECOLOGY

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The present ecological crisis has acquired a planetary-scale scope and is threatening both the biosphere and the human civilization. In the Russian Federation with its vast areas and rich natural resources the right of a man to a favourable environment is stated in the constitution. At the same time the trend of today's business is gaining enormous profits without regard to the costs of social and ecological character.

In the recent years the number of offences continues to increase, this concerning the field of environmental protection (illegal cutting of forests, pollution of water, soil and air), the sphere of replenishment of natural resources (the lack of compensation for the destroyed flora and fauna, dried-up water basins, reproduction of soil fertility, etc) and the rational use of natural resources (slash-and-burn agriculture, huge amounts of wastes, etc.).

Criminal liability for environmental offences is applied 200 times less frequently than administrative, which is taken for illegal deals with natural objects including the unauthorized use of the objects of the ecosystem; the unauthorized assignment of the right to the use of ecological objects; misuse of natural objects; violation of the rules of the use of ecological objects; violation of the norms of production and economic activities, which brings about damage to the objects of nature.

Such violations are often caused by the insufficient level of development of the material-technical base of production, the lack of binding of the technical project to the territorial characteristics: topography, forest resources, hydraulic objects, etc.; defects of disposal facilities; failure to comply with the rules of transportation of chemicals; the use of outdated equipment.

The environmental administrative offences are characterized by damage to the objects of both ecological and economic value. The destruction of forests, pollution of water basins and soils leads to additional expenses in the production of timber, agriculture, fishery, animal husbandry. Rehabilitation of the affected objects of the ecosystem, as well as reparations to the organizations and citizens, require huge financial costs and extra activities of specialists.

The excess of the optimal level of environmental risk which is supposed to take into account the minimal loss of natural resources, the possibility of their potential recovery, lack of harmful influence on a human being's health shall be recorded by the state ecological expertise, the conclusion of which is intended to correct the design-and- construction activities and commissioning of technical objects.

Of great significance for the prevention of environmental violations are such measures as educational work aimed at improving the overall cultural patterns with regard to ecology, the strengthening of public ecological control, actualization of social responsibility of both business communities and citizens of the state.

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STUDYING BIRD COMMUNITIES FOR ASSIGNING NATURAL PROTECTED AREAS

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Protecting watersheds of small rivers is extremely important for maintaining ecological quality of major water arteries. In this respect, such watersheds may be officially designated as natural protected areas (NPA). Additional criteria for this procedure include an intrinsic value of local biodiversity and patterns of annual population dynamics of endangered, rare and threatened species of flora and fauna. Thus, along with plant communities, avian communities may be used as bioindicators of smaller tributary watershed quality in the course of NPA designation.

In 2012–2013, we studied annual dynamics of bird communities inhabiting the watershed of Chardym River, one of the Volga River tributaries. Our goal was to identify annual changes in species composition and densities with special emphasis on those included in the latest edition of the Saratov Region Red Data Book [2006]. With this goal in mind, we carried out regular variable-strip line transect censuses [Emlen, 1977] of wintering avifauna, pre-nesting community at spring migration, breeding avifauna, and post-breeding bird community at late summer dispersion and fall migration. Densities of each species were calculated in individuals per square kilometer. The watershed under study included variety of habitats, such as flood-plain forests of black and silver poplars; white willow and aspen groves; shrub thickets of rosebushes, willows and Russian olives, sand and gravel beaches; wild steppe of fescue and feather grass, and agricultural landscape.

One hundred and sixteen bird species were detected over the time span of our research with ninety-six found breeding in the study area. The cumulative densities of bird community were at their lowest during the breeding period (varying 370–583 at different parts of the watershed) and the maximum in post-breeding season (970–1532). While some rather common conventional species dominated bird community, the variety of rarer species was found in the area, including thirteen species of raptors and seventeen species of water birds. Some not listed officially but unconventional and sparsely distributed over

European Russia breeding birds were at their stronghold in the study area. Those included *Jynx torquilla* (2.5 at the upper flow of the Chardym River watershed), *Picus canus* (3 at the lower flow area), *Phylloscopus trochiloides viridanus* (6.5 at the upper flow area), *Sylvia nisoria* (29 at the middle flow area), and *Carpodacus erythrinus* (21 at the upper flow area). The study area was found to hold strong viable populations of some declining migratory passerines, such as *Luscinia svecica* (74 at the middle flow area), *L. luscinia* (40 at the middle flow area) and *Acrocephalus palustris* (24 at the middle flow site).

Six enlisted in the regional Red Data Book species indicated an importance of the Chardym River watershed for protecting regional avifauna: two pairs of *Pernis apivorus* and four pairs of *Accipiter brevipes* were found nesting in the area; straying individuals of *Haliaeetus albicilla* were observed throughout the entire year except breeding season; *Dendrocopos medius* and *Lanius excubitor* occurred late in winter and early in the spring. Sixteen other detected species were on the Annotated List of Species of Special Concern of the Saratov Region [2006]. Those included: *Buteo lagopus* and *Anser anser* occurring at spring migration, *Parus palustris* detected in winter and post-breeding periods. Two pairs of *Coturnix coturnix*, one pair of *Streptopelia turtur*, seven pairs of *Milvus migrans*, eight pairs of *Accipiter nisus*, one pair of *A. gentilis*, six pairs of *Buteo buteo vulpinus*, five pairs of *Circus pygargus*, one pair of *C. cyaneus*, five pairs of *C. aeruginosus*, seven pairs of *Falco tinnunculus*, one pair of *F. vespertinus*, fourteen pairs of *Lanius collurio*, and 10 pairs of *Sturnus vulgaris* were found breeding at various locales of the Chardym River valley.

Another unconventional species we have discovered in the area was *Dendrocopos syriacus* wintering and breeding (one pair) in semi-open river valleys with scattered large willows and black poplars. Based on the results of our study, we propose the Chardym River watershed as a NPA, since it acts as an important refuge for avian communities during all seasons of the annual cycle. An officially assigned protected status would prevent further anthropogenic disturbance of the Chardym River watershed, which is crucial for maintaining the diversity and abundance of breeding and migrating birds of the Saratov Region as a whole. Further comprehensive studies of the local mammal, insect and plant communities are needed to make our proposal more convincing.

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RESULTS OF HARMONIZATION OF RUSSIAN VEHICLE EMISSION STANDARDS WITH EU DIRECTIVES AT THE EXAMPLE OF ST. PETERSBURG

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A direct step-by step introduction of EU vehicle emission standards, namely, Directive 98/69/EC of the European Parliament and of the Council of 13 October 1998, was proven

by the Russian Federation (RF) Government Decree No. 609 of 12.10.2005.

This was possible initially thanks to the decisions taken at the parliamentary hearings in the State Duma of RF (Russian Parliament) during the discussions on the draft Federal Law "On eco-friendly road transport of the Russian Federation" in 2000. It was extended than by the entry into force of the Federal Law of the RF "On the prohibition of the production and trafficking of leaded motor gasoline in the Russian Federation" in 2003. It was deepened later by the Technical regulations "Requirements to vehicle and aviation gasoline, diesel and ship fuel, fuel for jet engines and to fuel oil" since 2008 (harmonized with Directives 98/70/EC, 2007/46/EC, 2005/55/EC etc.) also aimed at the reduction of damaging effect of motor transport on air quality.

Since 2000 we have been regularly carrying out investigations on the effectiveness of direct introduction of European exhaust emission standards in the Russian Federation with regard to improving air quality in St. Petersburg.

For this purpose, as provided by Federal Law No. 96-FL "On Air Protection" of 04.05.1999 and by Directive 96/62/EC, we use computational, experimental and computational-experimental techniques, in particular, the "Settlement instructions for inventory emissions of pollutants from motor vehicles for the cities "of NIIAT, 2008, and the "Methodology for the definition of emissions of harmful substances related to traffic flows on roads and streets of St. Petersburg" of the "Committee on Natural Resources, Environmental Protection and Ecological safety of the Government of St. Petersburg, in 2012, developed with our participation. It should be noted that the mentioned above Techniques are harmonized with European driving cycles according to the Directive 2007/46/EC and are realized in software products elaborated by "Integral" Co.

Participation at several European projects since 2000 as coordinators and since 2012 as national experts has allowed us to apply latest European techniques and software products: a methodology based on the «Externe» for the forecast of external costs of transport functioning in St. Petersburg in the long term to 2030 (taking into account chemical and noise pollution of the atmosphere and traffic accidents), and the methodology and software COPERT - a tool to calculate air pollutant and greenhouse gas emissions from road transport. We have adapted both of them to the conditions of St. Petersburg.

These computational studies were in good correlation with the data of road-side monitoring of air quality in St. Petersburg.

The results of studies in St. Petersburg showed the effectiveness of the process of harmonization of the legislation of the Russian Federation with the Directives and Regulations of the EU. Thus, the calculated concentrations of CO, CH, PM, BP, Formaldehyde, SO₂, NO₂ along HDV free urban streets at peak hours have not increased in 2014 in comparison to previous years, and in some areas have decreased at grown traffic.

We have analyzed in detail the aspects of harmonization of Russian vehicle emission standards with EU Directives in reports of the European Commission project "Air Quality Management in the Eastern ENPI region (AIR-Q-GOV) ".

I.V. Lyanguzova

MONITORING OF SOILS: DYNAMICS OF CONTAMINATION AND POSSIBILITY OF REMEDIATION

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Laboratory of ecology of plant communities of V.L. Komarov Botanical Institute RAS for more than 30 years has been monitoring the state of forest ecosystems within the zone of influence of the enterprise on production of non-ferrous metals (Kola Peninsula, Russia). The main ingredients of air emissions are sulphur dioxide and polymetallic dust containing, primarily, the compounds of nickel, copper and cobalt. The most significant reduction of atmospheric emissions of pollutants by the plant celebrated the end of XX century, when the amount of sulfur dioxide emissions fell by almost 8 times, and polymetallic dust 5 times in comparison with their maximum values. In this regard, the purpose of this message is to identify the dynamic trend of the pollution level in the Al-Fe-humus podzols (Podzols Rustic) for the period 1980–2014, on-site buffer and impact zones, as well as to assess the possibility of remediation of contaminated soils.

The pollution level in the Al-Fe-humus podzols was assessed by the index of technogenic load, which was calculated based on the total content of mobile forms of nickel and copper in the organic horizon of contaminated soils in relation to their background content.

In the buffer zone average concentration of mobile forms of nickel and copper in the organic horizon soil over the entire study period were, respectively, 79 ± 10 and 132 ± 22 mg/kg, which 8–13 times more compared with the background values. By the end of the research period in the buffer zone there is an increase in the index of technogenic load 3–4 times. In the impact zone the temporal dynamics of the content of mobile forms of heavy metals in the organic horizon of forest soils was characterized by irregular fluctuations that are not related to mode of atmospheric emissions from the plant. Here the average concentrations of nickel and copper over the entire observation period was 545 ± 30 and 970 ± 87 mg/kg soil, respectively, these values are 50–100 times were above background values. Thus, in recent years (2002–2014) there has been a shift buffer boundaries and impact zones to the background area and the increase of pollution level Al-Fe-humus podzols by heavy metals in the entire study area, despite a 5-fold reduction in atmospheric emissions of solid substances by plant. This is due, on the one hand, additional annual intake of heavy metals from air to surface soil and plants, on the other hand, shows a high degree of fixation of heavy metals in the organic horizon of the soil and low speed washout in the underlying horizons. Due to the above reasons, the process of the purification of contaminated by heavy metals soil can't even begin. On the basis of data from long-term field experiment were calculated from the estimated speed and the period of purification contaminated by heavy metals soil: with the full removal of the environmental load on the territory of the impact zone, the period of self-cleaning of the top horizon of the soil to background levels may take 50–90 years. The length of the self-cleaning contaminated by heavy metals of soils can be judged by the speed of recovery of ground cover on

experimental plots: over the past 22 years in control of the herb-dwarf shrub and moss-lichen tiers recovered almost completely, and at plots with soil from the impact zone of the recovery process significantly slowed down.

Evaluation of the possibility of remediation of man-made wastelands near the enterprises of non-ferrous metallurgy was conducted on the basis of research conducted under the guidance of G.N. Koptsik (2013). Measures for remediation of anthropogenic areas should include wastes liming with dolomite and mineral fertilizers to reduce the acidity of soil, enrichment by nutrients and immobilization of heavy metals and the use of sorbents (vermiculite, apatite, tree bark, peat) to increase the sorption capacity of sandy soils. In addition, they must also include the systematic monitoring and periodic correction of acidity and nutrient regime soil with the aim of eliminating the deficit of nutrients and mobilization of heavy metals.

O.V. Lysikova

ECOTOURISM IN SARATOV REGION: VALUE FOUNDATIONS AND MANAGEMENT PRACTICES

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Millions of our contemporaries travel the world and the number of tourists increases every year. Each of these travelers has their own motives and values. From the beginning of the third millennium, tourism has become a powerful agent of social and cultural transformations of the modern world. Tourism has become common practice for many Russians, creating economic and cultural implications. Global tourism promotes the inclusion of Russian regions as tourist destinations.

Currently, we are witnessing an obvious separation between types of tourism, aimed at both urbanized agricultural areas. Ecotourism and rural types of tourism are actively developing, along with industrial forms of tourism. J. Urry examined processes of wasteland transformation into the landscape due to the influence of mass tourism.

At present, tourism is becoming an important direction of Russian regions' development. Russia ranks fifth among 130 countries in the world in the number of natural monuments and ninth in the number of cultural landmarks.

The main trends of ecotourism in Russia are an integration of natural and cultural components, dependence on climate changes, and high level of public interest to the topic of ecotourism.

In tourism, it is important to rely on professional management. Quality management of tourist services is closely linked to the life quality of the local residents. Travel in the region within the framework of domestic tourism should become a social norm and standard of behavior. In my opinion, we should actively promote the cultural and natural heritage of the Saratov Region. In our region, the priority areas are ecotourism, cultural, event, festival, educational, rural and wellness tourism.

These are my recommendations for the development of regional tourism.

1. There is a need for a qualitative change in transport infrastructure and the construction of economy-class hotels.
2. Of 259 nation-wide projects posted on Rostourism website, only one represented the Saratov Region: «Hvalynskie Hills». It is very important to develop project activities within the framework of the Federal Target Program «Development of Domestic and Inbound Tourism in the Russian Federation (2011-2018 years)».
3. Construction of bicycle routes in Saratov and surrounding areas is necessary for recreational activities of the local residents.
4. Development of long-term relations of the Saratov Region with other Russian regions and countries within the framework of ecotourism, cultural and educational tourism is very promising.
5. The greenway trails on the territory of the region are very relevant. The most promising areas for the development of ecotourism in Saratov Region are guided tours on greenway trails, birdwatching, fishing, and mushroom hunting. It is very important to construct and reconstruct the greenway trails for hiking, biking, skiing and horseback riding.

Weekend tours on specifically designed routes are very promising. This practice used to be very popular among people of different generations in the Soviet Union.

Master's Degree students in the field of tourism study topics of ecotourism and recreational tourism in academic disciplines: Theory and Methodology of Recreational Geography, Technology of Tourist and Recreational Planning and Territorial Development, Natural and Cultural Heritage of the World in Tourism.

Professional interests of Master's Degree students focus on the problems of land and water pollution, lack of professional management in the development of some districts of the Saratov Region, as well as on environmental education of local residents, and cadastral registration of natural monuments and cultural landmarks.

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MODERN TENDENCIES OF THE RUSSIAN TAXATION LEGISLATION AS AN ELEMENT OF THE STATE ENVIRONMENT PROTECTION POLICY

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Nowadays, the environmental situation in Russian can hardly be called good. This fact is proved by environment condition monitoring data and this situation is a result of applied industrial technologies which are resource-intensive, high-waste and inefficient from the standpoint of ecology.

Environmental component introduced into the company taxation system can be an

incentive to change the engineering equipment of industrial facilities and can adjust the same in accordance with contemporary environmental standards.

Taxes make up about 80% of the Russian budget. Thus, the share of the natural resources tax is very small and makes up about 12% of the total amount of tax proceeds within the structure of the Russian Federation consolidated budget.

Mainly, payments for using natural resources in the form of a rent and payments for hazardous emissions go into the budget. For example, the rate of the mineral extraction rent may vary from 1% for iron ore and ground water to 16% for high-quality oil and natural gas. Taxes on fuel and lubrication materials are set in percentage of an amount of sale of such materials: 18% (Federal tax) and 7% (local tax).

A fee for using aquatic biological resources is taken at the time of issuing a fishing quote. The fee can vary from 20 rubles for a ton of White Sea herring and salmon up to 10,000.00 rubles for a ton of crabs.

A fee for using territorial biological resources is taken as a special permission (license) or payment for 1 day of hunting. Penalties for poaching are set as well.

Thus, the compensation approach prevails in Russian Federation taxation system and experience has proven that this approach is inefficient from the standpoint of environment protection. Therefore, the relevant taxation system reforms are an urgent and timely matter.

It is important to note that there is an opportunity to change the structure of tax proceeds going to the budget without increasing the total amount of tax proceeds. It can be possible if the share of "green taxes" is increased. If the taxes on resources and development of the same at the initial stage of production chain are increased, the production development can move to a new level.

Increasing the tax burden on resource-intensive industries, the State should motivate companies to apply modern technologies which allow manufacturers to save financial resources at the initial stage and make them sure that they will get financial gain as tax benefits.

There are many opinions on the environmental tax reform. However, the eight highly-developed European countries have replaced a part of taxes on labour and capital with pollution taxes. In this case, tax proceeds going to the budget have not dropped but even have slightly increased.

Thus, this direction of taxation policy is an urgent matter for Russia which has great mineral reserves and forms its budget policy mainly of income from the sale of mineral reserves.

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DEAROMATIZATION OF STRAIGHT-RUN DIESEL FUEL BY USING ADSORBENT A4 AND SEOKAR-600 UNDER MAGNETIC FIELD

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Obtaining of ecological diesel fuel continues to be one of the important objects for petroleum processors. From year to year requests for diesel fuel quality becomes tougher. Special attention is given to sulphur and polycyclic aromatic hydrocarbons content.

So great attention to aromatic hydrocarbons content in diesel fuel is not casual because the quantity of solid particles and unburned hydrocarbons in diesel exhaust gas depends on it.

From environmental viewpoint most dangerous are polycyclic aromatic hydrocarbons. Source of their creation are PAH (polycyclic aromatic hydrocarbons) contained in diesel fuel and also formed in combustion chamber. Synthesis of PAH in combustion chamber occurs on basis of molecular association of aromatic hydrocarbons and pitches. It should be noted that polycyclic aromatic hydrocarbons in engine burns not fully and subside on combustion chamber walls, plunger, spray burners as sludgy deposits. It affects on engine work resource.

Traditional cleaning methods of diesel fuels from aromatic hydrocarbons are not economically sound because realized on high temperatures and with using of expensive catalysts and hydrogen. At present the alternative cleaning processes are adsorption and extraction dearomatization of diesel fractions.

Aromatic hydrocarbons can adsorb on special selected adsorbents better than paraffin and naphthenic hydrocarbons. Releasing aromatic hydrocarbons from oil products based on the above.

As regeneration process is a complicated process the problem of optimal adsorbent option continues to stay the actual.

At last years intensified the interest to low energy influence with which assistance it is possible to reconstruct the material structure without appreciable external expenditure of energy or with using of inside reserve of matter. As external action effected to material structure including oil disperse systems there can be used various variations of electric, electromagnetic, magnetic, vibration and acoustic fields.

Energy of magnetic field is one of the effective, economical and accessible types of energy. Magnetic fields are created by special apparatus – magnetotron and magnet activator, which have an effect on non ferromagnetic materials having different physical nature and under various aggregate states.

At this research work there were investigated adsorption dearomatization of straight-run diesel fuel under the influence of magnetic field. As adsorbent there were researched

reagent A4, developed by Institute of Petrochemical processes name after Y.Mammadaliyev from zeolite comprising adsorbent of local minefields and industrial catalyst Ceokar-600.

During investigation the raw stock subject to magnetic field influence with induction 15-100 mT, which correspond to magnetic strength of 150-1000 Oe.

There were determined physicochemical parameters of diesel fuel before and after running it through the adsorbent A4 and adsorbent Ceokar-600 and after magnetic field influence.

Investigation showed that content of aromatic hydrocarbons in diesel fraction by running of diesel fuel through adsorbent A4 decreased to 4,6% mass (to 28%). However on running it through magnetic field and adsorbent A4 the content of aromatics decreased almost to 52 and composed 7,9% mass. On passing diesel fuel through industrial catalyst Ceokar-600 content of aromatic hydrocarbons decreased to 1,1% mass (to 6,5%). Under magnetic field influence the latter decreased to 2,5% mass and composed 15%.

V.V. Markhinin

ENVIRONMENTAL ETHICS: THE CONTRIBUTION OF V.A. KOPTYUG

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Environmental ethics as a relevant trend of scientific thought has become increasing important in the context of the global environmental crisis in the second half of the twentieth century.

The German physician Albert Schweitzer (1875–1965) and the American ecologist Aldo Leopold (1887–1948) are considered the founders of environmental ethics and the persons who stressed the importance for implementation of those ethics. It should be borne in mind that environmental ethics has two main aspects: one biocentric and one anthropocentric. Only the biocentric approach builds on the theoretical heritage of Leopold and Schweitzer. Disappointingly, the literature dealing with environmental ethics disregards Vladimir Ivanovich Vernadsky (1863–1945), an outstanding thinker and scientist as well as the founder of the doctrine of the biogeosphere and its evolution into the state of the noosphere. Many people feel that V.I. Vernadsky should be considered one of the founders of environmental ethics; specifically anthropocentric environmental ethics. The importance of V.I. Vernadsky's teachings on environmental ethics is not sufficiently recognized owing to poor knowledge in the West about the study of these issues, about Russian theoretical thinking and about works written in Russian. A step in the right direction was the publication by James Lovelock (born in 1919), who, while creating his famous Gaia Hypothesis, rediscovered, so to say, Vernadsky's biogeochemical theory and brought to the attention of the scientific community the English translation

of Vernadsky's main work, *Biosphere*, which was made available on Lovecock's initiative to readers by a number of prominent Western experts.

In Russian-language literature on environmental ethics, several authors sharing an anthropocentric point of view (V.V. Mantatov, N.N. Moiseev, A.I. Subetto and A.P. Fedotov) trace their position back to the teachings of V.I. Vernadsky. Russian authors who criticize the anthropocentric approach in environmental ethics from the point of view of biocentrism (V.E. Boreiko, D.R. Weiner, V.A. Kutyrev and F.R. Stillmark) choose Vernadsky as their main target. At the same time, it is established that V.I. Vernadsky, regardless of whether the evaluation is positive or negative of the values of his ethical teachings on biogeosphere, is in fact recognized as the founder of the theoretical bases of the anthropocentric approach to environmental ethics.

The fundamental flaw of biocentrism in environmental ethics is, in my opinion, the attribution of moral subjectivity to all living beings and even more so to all natural objects. This flaw reflects the practical inconsistency of the biocentric approach to ethics. The initial step towards the practical implementation of biocentrism is an attempt to use it as the basis for environmental legislation by proclaiming the equality of the rights of humans and animals (or even wider of human and natural objects), which is a failure. More precisely, the failure of biocentrists, that of not wanting to see the obvious, is repeated time and time again. Is it not obvious that only human beings can be the subject of moral relations and of any relationship in general? The subject, the actor responsible for legal behavior, can only be human beings and not any other creature or entity, because they have no consciousness and, therefore, are legally incapable.

The teaching of V.I. Vernadsky, which demonstrated in the twentieth century that humanity, through science development and technical progress, is becoming a global force that determines the course of processes in the Earth's biogeosphere and is capable of giving scientific and philosophical justification to the anthropocentric approach of environmental ethics. This doctrine implies that the global environmental crisis that has been gaining momentum since the second half of the twentieth century cannot be overcome by eliminating anthropogenic impact. It is possible and necessary to overcome it by changing the nature of human impact, i.e. by changing the activity of human society itself. According to Vernadsky, the decisive factors in changing the nature of human activity are (1) the establishment of a just social order on the planet (scientific socialism) and (2) the cultivation of humanistic ethics and not misanthropy, as in biocentrism. This includes relations between people in dealing with nature.

One follower of V.I. Vernadsky's tradition in environmental ethics was Valentin Koptuyug (1931–1997), a chemist of world renown, president of the International Union of Chemists (1988), chairman of the Siberian chapter of the Russian Academy of Sciences (since 1980) and member of the United Nations High-level Advisory Board on Sustainable Development (1993). His contribution to the development of humanistic environmental ethics is to put ethics into the context of the internationally recognized

concept of sustainable development developed under the auspices of the United Nations. In that concept, V.A. Koptuyug emphasizes that Vladimir Vernadsky was the prophet of the need to lead civilization on a new path of development in the 1920s. In many aspects, his concept of the noosphere is the forerunner of the concept of sustainable development. For Koptuyug, the relationship between the concept of sustainable development and the doctrine of noosphere development is obvious, especially because this convincingly shows that this concept is in essence socialist concept. It is worthwhile noting that V.A. Koptuyug was a member of the Central Committee of the Communist Party of the Russian Federation and openly defended the idea of the need for feasible socialist reconstruction of the world, with Russia playing a pivotal role in resolving the global ecological crisis. He considered the bourgeois restoration as a temporary zigzag in Russian history. The scientific teachings and philosophy as well as his political activity has made V.A. Koptuyug a vivid example of the tangible social and practical importance of anthropocentric environmental ethics.

Cultivating a humanistic attitude towards nature, the essence of which is a desire to preserve natural diversity for future generations is seen by V.A. Koptuyug as a prerequisite for a just society and social system, considered to be a precondition for the sustainable development of the humankind and for its humane attitude towards nature. V.A. Koptuyug felt deeply about the multifaceted interdependence of the humanity's transition to the path of sustainable development and humanistic environmental ethics. This topic deserves a separate and more detailed analysis.

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NEW SORPTION-FILTERING MATERIALS FOR WASTE WATER TREATMENT

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The aim of this research was to develop optimal composition of the sorption-filtering ceramic material using mineral waste of different nature and to study sorption properties in regard to heavy metal ions and oil products depending on the composition of the developed material and firing temperature.

At present, the critical task consists in the development of such a composition of sorption-filtering materials that would have no economic or exploitation disadvantages typical for traditional natural sorbents and that would have good sorption properties in regard to heavy metal ions. In order to create such a sorbent, it seems practical to use natural aluminium silicates as raw materials. The aluminium silicates make up up to 50% of the Earth's crust, e.g. in the form of Cambrian clay, which is regarded as a polymineral hydromicaceous montmorillonite clay, known for its ion-exchange properties.

It is known from research work of scientists from the department "Engineering Chemistry and Natural Science", led by Professor L.B. Svatovskaya, that heavy-weight

concrete and foam concrete with calcium silicate hydrates have adsorption properties in regard to heavy metal ions. In this regard, it is possible to assume that sorbents obtained by firing of Cambrian clay and crushed foam concrete waste will also have adsorption properties in regard to heavy metal ions. In this research, we used structural and heat insulating concrete with the density of 500 kg/m³ on the Portland cement autoclaved binding material. Our earlier researches showed that the void volume of less than 10 µm in particles of crushed autoclaved foam concrete makes up 93.3% of the total void volume, and makes up 81.7% in the case of the non-autoclaved foam concrete. For this reason, we chose crushed waste of autoclaved foam concrete for our research. We obtained 16 samples of various composition and different firing temperatures. All samples were examined in their absorbing properties in regard to heavy metal ions. To determine the heavy metal ion concentration, we used ion-selective electrodes and an atomic adsorption spectrometer "Quant-2A" (flame spectrometer). In our research, waste water was replaced by cadmium, lead and copper ion solutions with the concentration of 10⁻³ mol/l and 10⁻⁴ mol/l. We chose these solutions because these metals are used in production in a significant amount and, due to their accumulation in the environment, represent serious danger because of their biological activity and toxic properties. The optimal contact time of the lead ion solution with the filtering material was 30 minutes.

Based on the data analysis, we chose the optimal composition with a sufficient stability and adsorbing property, with the clay/foam concrete ratio of 60×40 and the firing of 900 °C. The purification effectiveness in regard to lead ions was 100%, cadmium ions - 98%. The static capacity of the sorption-filtering material was 2.07 mg/g for lead ions, 0.64 mg/g for copper ions and 1.0 mg/g for cadmium ions. We also studied the sorption-filtering material in regard to its ability to retain insoluble oil products. The determined oil capacity was 0.3 g/g.

Based on our research, we developed a technological pattern of producing a sorption-filtering material. The developed material can be used for filter cartridges (1200 and 1800 mm high) as a combination mixture sorption-filtering material/activated carbon. Filter cartridges of this type are used for the purification of thaw water from heavy metal ions in snow melting equipment.

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INFORMATION SYSTEM FOR DECISION SUPPORT IN MANAGEMENT OF GREENHOUSE GASES AND WASTE

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Information technologies are used now in different fields of human activities and the sphere of their usage is permanently widening. One of such spheres is environmental

management which requires the collection, processing and analysis of large data volumes for informed decision-making.

At the department of Systems Analysis and Decision-Making of the Ural Federal University (Ekaterinburg, Russia) a specialized information system is developed for decision support in management of greenhouse gases and waste at the regional level.

The system provides collection, accumulation, processing and analysis of information, calculations of required indices as well as preparation of analytic reports and graphic materials. The methodology used is based on recommendations of "Guidelines for National Greenhouse Gas Inventories" (IPCC, National Greenhouse Gas Inventories Programme, 2006).

The system is intended for use at single workstation (the possibility of collaborative work may be realized in future) with Windows operating system version XP SP2 or later. It is implemented as an executable file, database file and auxiliary files.

There are four subsystems in the system:

- "Subsystem of Database Processing" is intended for input, checking, editing and selection of the information. This subsystem is implemented with use of "Absolute Database" format of the ComponentAce Company (ComponentAce, 2003-2012), that provides full compatibility with the standard of DB-Aware, strong encryption and compression as well as high speed and reliability.
- "Subsystem of Report Generation" serves for creation, visualization and printing of reports. The subsystem is implemented on the basis of "FastReports" technology (Fast Reports, 1998-2011). Generated reporting forms include standard tables and reports for each year as well as necessary analytical reports and graphical materials.
- "Subsystem of Data Export and Import" provides automated entry of raw data from the electronic records, statistical reports and other documents which contain the information needed. The subsystem is also used for export raw data and calculations results into other systems in common electronic formats (XML, CSV) as well as for export of the reports created in the "Subsystem of Report Generation" into PDF and XLS formats.
- "Subsystem of Kernel" serves for organizing of communication and data exchange between all subsystems as well as for implementation of the algorithms, logic, mathematical calculations and data analysis.

The data are protected from an unauthorized access by means of the user identifying by Username and Password. The users are also divided on several categories with corresponding level of access to specific system functions such as input, modification, copying, import, export, reports creation. In addition, the database is encrypted with cryptographically secure algorithm.

The System also includes the "Analytical block" which provides presentation of the input and output data as a tables or graphics and diagrams for requested category and time period that allows assessing of current situation as well as making forecasts for future.

In a whole, the developed information system presents a decision support tool in the field of environmental management in the terms of greenhouse gases and waste. It provides data processing on the basis of internationally recognised methodologies and allows getting all the necessary reports in standardized form.

The system was successfully tested during the inventory of greenhouse gas emissions and waste in the Khanty-Mansi Autonomous District of Russia and it may be adapted to the solution of similar problems in other Russia's regions bearing in mind the local conditions.

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ABOUT ENVIRONMENTAL IMPACT OF SAFYANOVSKOE COPPER MINING ENTERPRISE (THE MIDDLE URALS, RUSSIA) AFTER TRANSITION TO AN UNDERGROUND ORE MINING

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Safyanovskoe chalcopyrite deposit was discovered in 1985 and now it is one of the main sources of copper ore at The Middle Urals. The reserves of copper till the depth of 500 m were approved in the amount of 523 thousand tons. The deposit is located in the area of Rezh city, in 95 km northeast from the city of Yekaterinburg. Development of the field was started in 1994 by an open pit, and at present the upper part of the deposit is almost completely worked out up to depth of 160 m.

The second stage of field development is the extraction of ore by underground mining. The construction of the underground mine was started in the spring of 2010. Design depth of the mine is 500 m with approved reserves of 11 million tons of ore containing up to 3% of copper and also zinc, gold and silver. The planned annual ore production is 500 thousand tons. The mine will be put into operation in 2015 with output at full capacity in 2017.

An environmental monitoring system has been operating at the enterprise from the beginning of mining that allows evaluating and forecasting its impact on the environment on the basis of the data on the observed pollution levels in the surrounding atmosphere, hydrosphere, soil and vegetation.

Institute of industrial ecology of the Ural Branch of the Russian Academy of Sciences has been conducting annual studies of the pollution of water (8 sampling points, 3 times a year) and bottom sediments in rivers and creeks (8 sampling points, 1 time a year), soils and vegetation on meadows (12 sampling points, 1 time a year), snow cover (38 sampling points, 1 time a year) and condition of herbaceous forest vegetation (6 plots, 1 time a year) in the influence zone of the mining company.

On the basis of the monitoring data one can give a preliminary assessment of

Safyanovskoe mining enterprise influence on the environment after transition to the underground ore mining. Some results of such assessment are presented below.

The impact on hydrosphere. Cleaned mine waters are discharged into the Rezh river. The data on pollution of the river bottom sediments show that the content of copper and zinc (the main ore components) in them varies from year to year as upward so and downward with respect to the average meaning. Any unidirectional trends in the pollution dynamics are not observed that indicates the absence of sustainable negative impact of the mine on the surface waters. After the start of the mine construction, no significant changes have happened in the content of copper and zinc in the sediments. In the period of 2010 - 2013, they remain below the average for the entire period of observations since the beginning of the field development in 1994. For instance, the copper contents for these years are as follows: 23.1, 21.5, 30.5 and 19.4 mg/kg respectively.

The impact on vegetation. The indicators of forage crops pollution by ore metals at the fields around the mine in the period from 1996 to 2013 remain in the 1.5-5 times lower the normatives. Besides, any unidirectional changes of the metals concentrations in the samples, as well as their dependence on the sampling points location around the industrial site are not observed. In this regard, there is no reason to talk about the mining works impact on the quality of the meadows vegetation. Since the beginning of the construction of an underground mine the nature of the dynamics of vegetation contamination has not changed. In particular, the average copper contents in the vegetation were 9.97, 10.23, 14.49 and 5.94 mg/kg in 2010- 2013 respectively (whereas the normative value is 30 mg/kg).

In a whole, for the period of the construction of the underground mine (2010-2013), the increase of the environmental pollution around the mining enterprise is not observed. Thus, it is possible to predict that after the complete transition to an underground mining the environmental impact of Safyanovskoe mining enterprise will not exceed existing levels, which fully correspond to the Russian environmental standards.

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ASSESSMENT AND MONITORING OF GAS POTENTIAL IN ASTANA WITH THE DEVELOPMENT OF LANDSCAPE ECOLOGICAL FRAME

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The main source of the negative impact on the human environment and greenery is transport complex. Currently, studies of contamination of roadside space in Astana limited to heavy metals, especially lead. Due to the significant changes in the requirements for

environmental quality cars and fuel assessment of lead contamination of the environment components is becoming less relevant, while taking into account the need for other pollutants such as volatile organic compounds are becoming increasingly popular. The most toxic components of exhaust gases of vehicles, including carcinogens are “uncontrolled”. In today's world urban planning use construction of landscape-ecological framework, which serves as the basis of green building city.

The purpose of the study is to identify geochemical regularities of volatile organic compounds migration for monitoring gas potential and lay the foundations for solving environmental problems in the city of Astana, associated with green building.

The objectives of the study are: the development of science-based landscape ecological framework of the city, which will be the basis for a green building; compilation of a series of digital thematic maps for the city geostructural carcass; evaluation of the level of planting and condition of roadside planting by traditional methods of research and remote sensing; offer of plant species with high adaptability to the landscape conditions of Astana in accordance with the landscape-ecological framework.

The research results revealed qualitative and quantitative composition of volatile organic compounds (VOC) of transport emissions at a roadside space. Studies of ecological and biological characteristics of accumulation of VOC in the system “soil-plant-soil water” helped justify landscape-geochemical regularities migration of VOC for making practical recommendations on the range of greenery.

On the basis of the research of roadside plantings identified indicator species of plants with high capacity to store gas in the food chain “soil - plant - ground water.” Ecological mapping of Astana is carried out oriented accounting gas protection-building plants with a high adaptability in the system “soil-plant-soil water.”

The first time obtained the results of urban environmental studies for the preparation of popular and scientific articles covering the actual problems of the subject, which can be used also for other cities in the steppe zone, not only in Kazakhstan but also near and far abroad.

On the basis of the research compiled applied digital maps of specific variety of greenery considering gas protection building.

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OPTIMIZATION OF BIOGAS PRODUCTION PROCESS AS AN ALTERNATIVE ENERGY SOURCE AT ANAEROBIC TREATMENT OF WASTE

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Due to the planned increasing of farm livestock animals in Kazakhstan assumed the high concentration of animals contributes to the accumulation of large volumes of unused

manure around the farms. It will create the conditions for groundwater and air basin contamination, as well as the biological contamination of pathogens neighborhood areas. Today, the biomass is available everywhere, but in most cases it is seen as a problem, but not what it actually is, as an energy resource. Biogas technology is still evolving, not being optimized, and thus is not fully cost-effective.

There is huge potential for biogas production from various types of organic residues, waste AIC, as well as from various energy crops. Today, this biomass is available everywhere, but in most cases it is seen as a problem, but not what it actually is, as an energy resource.

Purpose is to increase the efficiency of anaerobic digestion of organic livestock waste by pre-treatment of raw materials, optimization of its composition, process parameters and operating modes of the fermentation process.

In European and international practices an unambiguous relation has not been developed to the need for the hydrolysis of organic feedstock in the process of anaerobic digestion. This is due to the lack of scientific evidence on the effect of hydrolysis on the production of biogas, especially for diverse organic compounds mixed. The most typical process parameters of a microbiological process of fermentation of organic materials are the values of acidity (pH) ratio of volatile fatty acids to the inorganic carbon (FOS/TAC) and total nitrogen to total carbon (C/N). If these values are in the range of the optimum, the generation of biogas from organic raw material is most effective. Recommended in the literature, however, the optimal values of the above parameters have different large spread. Therefore, scientific novelty will also be to determine the optimal values (pH), (FOS/TAC) and (C/N) for different compositions of mixed organic materials.

In the international practice there is an information gap regarding the optimization of biogas plants. Biogas industry and academic institutions, as we are focused on finding solutions, are gradually increasing the productivity of the process.

It is supposed to be the study of the influence of electrokinetic disintegration of colloidal particles on the quantity and quality of biogas; study of the effect on the efficiency of biogas production process of pre-hydrolysis of raw materials; study of the effectiveness of different ways of mixing; optimization of the substrate composition on the basis of different types of organic material; study of kinematic viscosity and surface tension of fermentable substrate; determining the morphological and biological properties of microorganisms; determination of the chemical composition of the eco-fertilizers; develop a methodology for engineering calculation of the bioreactor; develop industrial sample of the biogas plant based on the complete cycle of current studies.

The most typical process parameters of a microbiological process of fermentation of organic materials are the values of the acidity (pH) ratio of volatile fatty acids to the inorganic carbon (FOS/TAS), and overall carbon to total nitrogen (C/N). For subsequent decisions the task, which consists in determining the optimal values (pH), (FOS/TAC) and (C/N) for different compositions of mixed organic materials.

O. V. Mezinova

REGIONAL STUDIES WITH REGARD TO ECOLOGY IN YELETS: PROBLEMS AND PERSPECTIVES

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Regional studies pertaining to ecology are becoming more demanded and popular in Russia. This can be accounted, on the one hand, by increased attention of the public towards the problems of environmental protection and ensuring ecological safety of life in the region, on the other hand, by the present opportunities of involving common citizens in the activities of ecological character and a wide range of scientific problems in the field, either little developed or undeveloped at all.

Ecological regional studies are centered upon researching the interconnection, interconditionality and interaction of separate components of the ecosystem, arranging the control of anthropogenic activities to form an estimate of its influence on the environment of the region, fixing natural and artificial changes of the relief, establishing the interdependence of economic activities in the region and environmental conditions, and making up the complex characteristics of the territory, cultural and historical, geographical, ecological and other aspects being considered.

Educative activities constitute an important branch of regional studies of ecological nature. They considerably allow broadening the knowledge about the biosphere, to raise the level of ecological culture of the citizens, which generally contributes to developing a conscious attitude to protection activities and gives the opportunities of forecasting the results of the interaction of the community and nature and introducing respective corrections on their basis.

Ecological regional studies are developed while considering two aspects: social and educative. At present there are no state organizations in the Russian Federation, among the tasks of which would be the realization of the programs of regional studies with regard to ecology. The mission has been taken by social organizations that unite enthusiasts wishing to study the natural environment of their native land and render assistance in matters of general improvement of the environment in the region. They arrange different actions and events, take an active part in the work of the Internet-community.

In this way, not once did the town of Yelets, Lipetsk Region, welcome ecological festivals “Solntse-stan” (=The sunny camp); the site “Eco-Yelets” is engaged in reflecting on the news of ecological education in the town, arranging competitions of the artistic photographers and landscape-painters of the region, supporting links with ecological communities of other cities and regions in Russia, organizing control of the activities for the protection of nature and publishing its results, conducting the educative work among the teenagers.

Ecological regional studies are carried out within the framework of the activities in circles and scientific problem-solving groups organized at educational institutions of different levels: secondary, vocational, technical schools, colleges and universities. Regional and inter-

institutional scientific practical conferences are held with emphasis on ecological regional studies.

Institutions of further education are also occupied with the work dealing with ecological regional studies, to these belong art schools organizing painting sessions in the open air, stations of young technicians participating in ecological actions, ecological voluntary movements, and engaging themselves in modeling, the objects of the ecological system of the region being included.

The perspectives of ecological regional studies are to be seen as joint actions for the organization of regional clusters, support to the functioning of nature reserves and interaction as regards ecological education.

Elena Milanova

MULTILEVEL ENVIRONMENTAL EDUCATION FOR SUSTAINABLE DEVELOPMENT IN RUSSIA

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An International implementation scheme for the Decade of Education for Sustainable Development (DESD, 2005-2014) proposed the fostering of environmental education as an important tool in the integrating people knowledge and learning strategies, strengthening links between learning and research of environment. This issue becomes important for Russia when the increase of oil and other mineral resources mining lead to worsening of the environmental situation, that's why it is vital to raise environmental aware and responsibility of the young generations.

The different types of continuous environmental education in Russia are considered. Basic high school environmental education delivered principally through universities and institutes. The system of multi-step higher education includes bachelors (4 years), diploma specialists (5 years) and masters (6 years), but some of universities exclude now diploma specialist level to be more compatible with the educational system in the Western world. Applied engineering environmental education opportunities mainly provided by technological universities, specialized institutes, and related with different environmental problems resulting from anthropogenic impact.

Strictly speaking environmental education starts in the kindergarten where children are getting basic knowledge on the environment. This initial stage of environmental education characterized by the high level of clearness and should be extremely easy to understand by small children.

School education divided into class and extra-curricular exercises. Class activities includes study of the most important environmental issues while the goal of extra-curricular exercises is to develop practical skills and creative thinking in ecomanagement and nature conservation. One of the important direction of extra-curricular study is deep knowledge of youth homeland nature, traditions, history (this curriculum is calling in Russia 'kraevedenie'),

that favors the development of love to their “small homeland” and willing to improve its environmental and economic conditions.

Extra-curricular youth education requires the complex pedagogical approach combining theoretical lessons providing a background of environmental knowledge to children and youth, and practical lessons to initiate in a child interest to nature and to develop love and careful attitude to it.

The very important form of extra-curricular environmental education is “field ecology” - the forms and methods of which help children and youth to investigate nature through concrete objects - animals, plants, ecosystems in-situ (their natural habitats). This approach based on outdoor lessons - excursions, “field” practices, and expeditions. Very often such form of environmental education closely related with volunteer work of youth in nature protected areas, and public recreation sites. It could include cleaning the territories, construction of ecotrails, specially equipped for the ecotourism and educational purposes, documentation of local tourist objects and nature heritage sites, especially not yet included in touristic paths and state/regional register lists.

The very important role in development of extra-curricular youth education is an important mission of public and non-governmental organizations. We studied the different forms of extra-curricular environmental education were: environmental games - the game activity of the participants stimulating a high level of motivation, interest and emotional participation; children’s environmental movement - mass form of environmental education, organizing and coordinating eco-volunteers. NGO “Fund for Sustainable Development” within the joint UNESCO Moscow Office/Coca-Cola HBC Eurasia programme the Living Volga, participated in development the structure and concept of the game Brain Ring for children aged from 12 and youth devoted to environmental issues of the Volga Basin flora and fauna. In addition, the project “Green Schools” was implemented in Moscow under support of ExxonMobil company: the schoolchildren was studied the new practices for energy-water-wastes management, improving environment inside schools and in the backyards. The multilevel environment education assumes the bi-vector matrix of basic and applied environmental education with participation of academic institutes and non-governmental organizations and allows building viable and environmentally sound education system.

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PROSPECTS OF USING HEAT-WATER UNDERGROUND TANKS IN THE CHECHEN REPUBLIC

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Geothermal waters are potentially an important source of valuable minerals and metals. These fluids are heated in the natural heat flow of the bowels of the Earth. High-temperature geothermal waters, whose temperature is usually higher than 120° C, are used to produce

electricity, while the low-temperature water is used directly for heat supply in the economy, such as agriculture, aquaculture, and space heating. Prolonged contact of geothermal water with rocks from the upper layers of a silicate crust leads to the dissolution of minerals and metals in rocks. High temperature of these waters promotes greater accumulation in them the full range of chemical elements.

Exploitation of geothermal resources leads to discharge water containing significant concentrations of trace elements. On the one hand, the tramp supplements geothermal water adversely affect corrosion resistant pipe and sewerage supply, leading to frequent breaks and to increase the cost of operation of geothermal heat. This often makes any further use of hot water is almost unfeasible. On the other hand, these water solutions can be processed to recover minerals and metals. Key potential products derived from geothermal fluids are silica, zinc, lithium and other metals. Recovery of minerals and metals of geothermal fluids can be regarded as additional production at existing power plants or as a separate production of precious metals. Silica is widely occurring component in geothermal solutions and, as a rule, its content is quite high. So when extracting chemical components from solutions, silica should be removed in the first place, or its concentration must be significantly reduced. Most hydrothermal systems are in equilibrium with quartz (SiO_2), leaving silica reflects the temperature of the tank. The hot water tank, the higher the concentration of silica in gidrothermal solution. During the production of geothermal energy solution is cooled, the water evaporates. Both processes lead to overtreatment fluid on silica. Ultimately, silica, usually deposited in colloidal form in various parts of the Power Plant or injection wells, causing them to rust. The silica will be deposited on the equipment for production of other useful feature if its concentration will not be minimized prior to production. Removal of silica from the solution is a key element for future use. Thus, in addressing the issue of the withdrawal of the silica solution, solved two tasks at the same time- the possibility of further use of the thermal heat and industrial quantities of silica as a valuable component of the industry.

The territory of the Chechen Republic is one of the most promising regions of Russia with large resources of thermal waters in 14 fields. A large number of geothermal reserves, high production rates and temperature, low mineralization, low corrosivity water deposits are promising comprehensive use of thermal waters of the Chechen Republic. The use of this energy is an environmentally friendly process, creating circulation systems for reservoir pressure maintenance at fields eliminates the discharge of water, minimizing damage to the environment.

The quality and properties of the thermal waters of the Chechen Republic allow to use them in an integrated manner: to generate electricity; heat supply; extraction of chemical components, in particular Silicon; the balneology, etc.

The work is done under state contract No. 13.1738.2014/K «Geochemical studies and elaboration of practical recommendations regarding geothermal deposits in the Northern Caucasus to reduce aggression in the construction of geothermal plants», with the support of the Russian Science Foundation.

Darya Motakova

THE GREEN UNIVERSITY: START WITH SEPARATE WASTE COLLECTION

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Waste management is one of the most pressing environmental problems in Russia. The solution lies in sustainable practices for waste management, including processing. Higher education institutions are a good place to start implementation of separate waste collection: a large concentration of young flexible people creates a favorable environment for fixing this practice for making it a norm of behavior. Environmental education of future specialists and managers will facilitate the transition of the state to the principles of green management administering.

The Peoples' Friendship University of Russia (PFUR) is one of the largest and most famous universities in Russia. Largely PFUR is a trend setter in the sphere of higher education. In early 2013, the students of the environmental faculty of PFUR initiated separate waste collection in office buildings and campuses. With the support of the Moscow authorities a multi-purpose youth center was established by a student initiative group, which was engaged in the development of a detailed project that includes environmental, economic and social aspects.

The objectives of the project are to increase the awareness of students about environmental problems and their solutions, as well as to reduce the carbon footprint from the activities of the University. The transition to a separate collection of waste consists of several stages:

1. a pilot project in the building, of the environmental faculty (started September 1, 2014)
2. the transfer of all administrative buildings to separate waste collection (until September 2016)
3. the introduction of separate collection of waste in the campus (2016 - 2018)

In the first stage of the project a Green week was held: that is a big festival dedicated to environmentally friendly lifestyle. Lectures, workshops and film screenings were devoted to green activism, the estimation of the ecological footprint and possibility of implementing green management in the University.

In April 2014, the project for separate waste collection was presented to the rectorate of PFUR. As a result, it issued a decree about the launch of separate waste collection in PFUR.

Today, at the environmental faculty there are additional bins for paper, plastic bottles, glass and iron on each floor of the building (recycling point) and corresponding containers in the courtyard for accumulation.

According to a sociological survey, 75% of the students and staff of the environmental faculty are positive about separate collection of waste but at the same time cases of

wrong sorting are fairly common, means that we should continue the information campaign about the rules of waste sorting.

In the coming year it is planned to introduce separate collection of waste at the agricultural and medical faculties. Total investment in infrastructure for the organization of separate collection of waste throughout the University does not exceed 200 thousand euros, and the payback period is estimated at 12-14 years.

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METHODOLOGY OF FORMATION OF ECOLOGICAL COMPETENCE OF STUDENTS

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Today there are no more important problems than the problem of a harmonious relationship with nature. Responding to the difficult ecological situation in the region and in the world Kazakhstan actively promotes the principles of «green» economy. There is developed partnership program «Green Bridge» and the Global Energy and Environment Strategy, which reflected in the outcome document «RIO+20». Kazakhstan attaches great importance to the environmental dimension of the OSCE and the SCO seeks to increase sustainability in the production of goods and services.

Initiatives of Kazakhstan fully supports by international community. In 2017, Astana will organize world exhibition EXPO-2017, with basic theme – «Future Energy» – allows to develop and distribute a global idea of the transition to a «green» economy from the very center of the Eurasian continent. The project for the development and use of alternative energy sources is a visionary, environmentally and economically beneficial. The exhibition will help to solve many problems in the complex: to reduce the pollution of the atmosphere, to learn to save energy and to adopt innovative technologies.

The transition to a «green» economy will perform highly educated people who have moral and physical potential. The education system should prepare young people to address environmental and economic issues, to bring up the principle of shared responsibility of a man for his health. Health of the nation is a guarantee for state's success and much is being done to protect the public's health.

A new paradigm of development of Kazakhstan is defined. Main catalyst, core values should be the culture of interaction in the community, responsibility before our nearest. Therefore it is necessary to work on the formation from the person and society valuable relations to nature, to yourself, to other people, to whole society. If sayings about high school, the focus should be on the formation of environmental competence. This problem is particularly relevant for engineering students. Therefore, high school education policy should be directed to the formation of ecological competence of students in technical disciplines. On this plan for teachers falls great responsibility.

The analysis of the literature showed that the problem of the environmental competence of engineering students is highly relevant, but is still far from being resolved. A set of environmental knowledge acquisition has been proposed but it is hard to implement in professional practice since it does not ensure the functioning of all pedagogical process components from the point of environmental safety, including the relation of general, humanitarian, and professional training. There is a failure to understand that one of the main factors reducing occupational risks is development of future specialists' moral qualities. Development of trends of engineering students' environmental education lag behind the humanistic tendencies of the development of higher education; the use the competency approach is limited by technical side, without considering the spirituality formation issues.

In other words, certain contradiction between the needs of society and the state in environmental competent technical specialists and reality in educational theory and practice of higher education, the lack of models, systems and methods of the environmental competence of university students enrolled in technical disciplines are observed.

Environment, health, morality, spirituality, hard work, patriotism, nature conservation, development of alternative energy sources - all of this is connected with the formation of environmental competence. To the forefront need to conduct research, aimed at theoretical and methodological substantiation and development of models, systems and methods for engineering student's environmental competence.

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M.M. Vakaraeva
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TOXICITY ASSESSMENT OF A POLYMER COMPOUND WITH ANTIMICROBIAL PROPERTIES

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Currently, chemotherapy are widely used preparations for treatment of infectious diseases in humans and animals. In the practice of medical science and veterinary, thousands of effective antimicrobials are used. However, one of the major disadvantages is their toxic effects on various organ systems in case of their long-term and systematic admission.

Search for biologically active compounds that would combine strong antimicrobial activity and low toxicity is an urgent problem for applied microbiology along with veterinary and medical science.

The goal of our work was to study the acute toxicity of polymeric compounds: poly azolidine ammonium modified by hydrate halogen ions (PAAHH). This compound has high antimicrobial activity.

We used four following variants of the polymer: iodine hydrate ion concentration

was 100 µg/ml in PAAHH-2, 200 µg/ml, in PAAHH-4, 500 µg/ml in PAAHH-10, and 750 µg/ml in PAAHH-15. Acute toxicity was identified for different concentrations of polymer compounds. For this purpose, double serial dilutions were prepared from compounds 1000 µg/ml to 2 µg/ml.

At the first stage of our study, we conducted a preliminary assessment of toxicity of the test versions of the polymer using bioassay-object - *Daphnia magna* Straus.

Acute toxicity of polymer compounds to *Daphnia* was determined by their mortality for the period. The criterion for acute toxicity of the compounds was the death of 50 % or more of bioassay objects for 48 hours in the test samples compared to the control, in which all crustaceans maintained their viability. In experiments, assessment of acute toxicity is determined by several factors:

1. LK100-48 - lethal concentration of the compounds causing the death of 100% of test organisms.
2. LK50-48 - average lethal concentration of the compound that causes the death of 50% or more of the test organisms.
3. BK10-48 - harmless concentration causing death in 48 hours of fewer than 10% of the bioassay objects.
4. BK0-48 - minimum harmless concentration of preparation, at which death of bioassay organisms was observed.

Then, the acute toxicity of compounds was studied in laboratory on white mice by a single intraperitoneal administration of various concentrations of PAAH in a volume of 0.2 ml to animals.

Observation of animals was performed after injection of drugs within 14 days. On the first day after administration of the compounds, mice were under continuous supervision. During observations, we took into account physiological state of animals, number of dead and surviving animals. On the basis of our results, we assessed toxicity of the studied compounds by determining LD50 values.

Since all investigated polymer concentration options did not cause bioassay object's death and preserved their normal physiological activity, we considered those concentrations of the compound non-toxic. We were unable to establish lethal dose LD50 for all variants of PAAHH, because intraperitoneal administration even of the maximum concentration (2000 mg / kg) of this polymer did not cause death of animals, and side effects were absent.

Our results permitted us to consider investigated variants of poly azolidine ammonium modified by the hydrate halogen ions (PAAHH) non-toxic. Preliminary testing of this compound on bioassay objects allowed classifying it to the toxicity class IV. This finding makes it possible to consider these compounds as promising non-toxic antimicrobial and antiseptic preparations of broad spectrum.

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PROCESSING OF FINE-DISPERSED WASTE FROM SILICON PRODUCTION

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Today, one of the main tasks is to reduce production cost, primarily by decreasing energy usage and by involving coproducts or waste into technological processes. In the production process of metallurgical grade silicon, when treating (in the course of one year) dust-gas mixture from ore-thermal furnaces, the volumes of cyclone dust and sludge after wet separation which go to a sludge depository make up, on average, 1654.8 and 35105.21 tons, respectively. For this reason, the problem of utilization of this waste is very critical today.

Technical (metallurgical grade) silicon in industrial-scale volumes is manufactured in arc ore-thermal furnaces. The process of its extraction during the carbothermal reduction from silicon-containing raw materials can be presented in the form of the main chemical reaction: $\text{SiO}_2 + 2\text{C} = \text{Si} + 2\text{CO}$.

The studies of properties of dust that remains after silicon production showed that 85% of the dust are made up by spheroidized SiO_2 particles. The dust volume makes it possible to recover the waste and recycle it, which will significantly decrease environmental stress in the industrial region. The fineness of the dust varies between 12 nm (individual nanoparticles) and 200 μm . It was determined that one of the conditions that guarantees the formation of spherical particles of silicone dioxide is the existing modes of silica gasification processes. These modes are mainly determined by the possibility of the complete use of the gaseous silicon monoxide in the silicon carbide formation and destruction reactions as well as by the maximum speed of $\text{SiC}_{(t)}$ destruction with the formation of elementary silicon in the high-temperature reaction zone of the electric furnace.

It is impossible to use dust in the carbothermal production directly, that is why it is necessary to apply preparatory methods of burden materials agglomeration. We offer burden material preparation methods which allow obtaining steady porous agglomerated blends.

Dust after gas purification and oil coke were used as burden materials. The formation of the porous structure is based on the reaction of interaction between fine silicon (screenings) and sodium silicate (liquid gas), with the release of gaseous hydrogen.

The agglomerated blend has to be stable enough when being transported and put into the furnace. An indicator of mechanical stability is the release coefficient (R_{rel}) (State Standard 21289-75). It depends from several factors: the duration of the agglomeration process, content of the binding material, fineness of Si particles, solid-liquid ratio and the reaction temperature. As the main factors, we chose the duration of the agglomeration process (x_1), the content of the binding material (x_2) and the fineness of silicon particles (x_3). The obtained mathematical model of the agglomeration process is as follows:

$$y=43.43-5x_1-4.3x_2+12.1x_3-2.82x_1x_2-3.97x_1x_3-1.82x_2x_3+0.8x_1x_2x_3$$

The results of our research showed that in order to obtain the most stable agglomerated blends ($R_{rel}=69\%$), the optimal conditions have to be as follows: the duration of the agglomeration– 150 min, the content of the binding material – 20 % and the fineness of fine silicon particles – 0,05 mm.

The experiments were carried out in the operating plant “Closed Joint-Stock Company Kremnij” (Shelekhov), in which the main lump charge material received agglomerated blends (10%) produced by using our method which showed stable current capacity of furnaces and normal burden descent into the reaction zone.

L.A. Nikitina
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APPLICATION OF THERMAL DOSIMETRY IN CRYOGENIC TREATMENT

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The method of thermal dosimetry was developed by analogy with the theory of radiation dosimetry, used in radiobiology. Radiation or ionizing radiation consists of three kinds of actions on the object, firstly, the alpha rays (particles) composed of helium nuclei, secondly, beta rays, is a stream of electrons, and gamma-rays being electromagnetic radiation of high energy emanating from the atomic nuclei in nuclear transformations elements. In addition, each type of radiation transfers energy to the substance and thereby increases its temperature, which can be taken as a new quantitative characteristic of absorption of radiation by matter. Here, the low temperature impact is investigated on laboratory rats, placed in an insulated box with a tray inside which is filled with liquid nitrogen. Under the pallet has a slatted floor, on which the test sample is placed beside her sensor. After a certain time write temperature values using the data obtained construct a graph of temperature versus time. Thermal dose (s) defined as the area of the figure of the graph line to the x-axis from bottom to top. In the international system of units temperature dose has the dimension of a second degree. To practice more comfortable off-system unit called Stephen - degree view of the minute. The formula for calculating the specific thermal dose:

$$S_{sp} = \frac{S_t}{m} \quad (1)$$

Where, S_{sp} - specific thermal dose, S_t - thermal dose, m - mass of the rat. Thermal dose is similar to the concept of exposure dose, defined by the number of ions those born substance upon absorption of radiation. It is an integral characteristic of the temperature influence on the object.

This method allows creating a thermal dosimetry new mathematically and physically sound quantitative method of controlling the effects of cold on a biological object.

For the experiment on the healing of deep skin wounds in laboratory rats were selected 2 groups, group 1 - Experimental (3 rats), 2 control group (3 rats). At a certain part of the body of animals suffered wounds same size. After carrying out these manipulations experimental samples were placed in a cryo-chamber and received a dose equal to a specific temperature -1126St. One day after the session cryotherapy has been found that in the experimental samples the wound is completely healed and the control rats wound healed after 5-7 days.

In such a way, the methods of thermal dosimetry allow to quantify the dose of the therapeutic effects of temperature on living organisms.

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STUDY OF TRITIUM CONTENT IN WATERS OF THE SAKHA (YAKUTIA) REPUBLIC

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Natural sources of tritium are rain and snow, as almost all the tritium produced by cosmic rays in the atmosphere goes into the water.

A large amount of tritium produced in nuclear and thermonuclear explosions. From 1974 to 1987, the territory of Yakutia was produced 12 peaceful underground nuclear explosions (most of which thermonuclear) as a result of the two of them - "Crystal" and "Kraton-3" - happened contamination of the environment by products of nuclear fission.

Currently, nuclear power plants around the world uncontrollably spew tritium and are not precise instruments, with which can to determine how much tritium is released into the water, in the air and on the ground.

The aim of in question work is to measure the tritium content in the waters of the Republic of Sakha (Yakutia) by device Hidex 300 SL, which has a sensitivity of up to 1 Bq (currently only in the Far East) and its comparison with the radiation safety standards. For attainment this objective, were delivered the following tasks: 1) to collect samples of water from rivers, lakes, snow, ice and swamps; 2) Samples of rainwater and water from the sediment; 3) to measure the tritium content in the samples on a liquid scintillation spectrometer Hidex SL-300; 4) compare the results with data on "Radiation Safety Standards NRB 99/2009."

Samples were taken from the Mirny, Oymyakon, Kobjajsky regions and the city of Yakutsk. Background tritium varies from 8.2 Bq / l to 201.85 Bq / l. The maximum content of the background tritium showed water from the Mirny region, and the minimum content - from Kobjajsky region.

According to the "Radiation Safety Standards NRB 99/2009" value of dose coefficient

ϵ (mSv / Bq) at entrance of radionuclides in the organism of adult people with water and level interference [LI (Bq / kg)] on the content of individual radionuclides in drinking water H-3 (tritium): ϵ (mSv / Bq) - 1,8-8, LI (Bq / kg) - 7600.

Based on these results, we found the maximum is - 201.85 Bq / l, which is 37.6 times lower than the a possible concentration is maximum.

Since the interference level of tritium is 7600 Bq / l, it is possible to do next conclusions, that content of H- 3 is in waters of Republic of Sakha (Yakutia), corresponds to with the radiation safety 99/2009, that is not large threat to public health and environmental pollution.

S.S. Nurkeyev
A.S. Nurkeyev

DEVELOPMENT OF PROCESSING FACILITY FOR UTILIZATION OF MSW POWER POTENTIAL

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One of the main problems of modern world is development of power industry and provision of this industry by energy sources.

The problem of provision of constantly growing demand of world/national economy by power determines the need for development of renewable energy, and in particular bioenergy. Development of renewable energy sources also reduces burden on fossil fuel extraction industries and increases level of environmental security.

On May 30 President of Kazakhstan signed a Decree "Concept of transition of Kazakhstan to the" green economy "." The concept establishes a foundation for building a new waste recycling sector in Kazakhstan, which will provide great opportunities for employment of the population.

Among the indicators of waste utilization Concept provides complete coverage of settlements by removal and sanitation keeping of 95% of waste by 2030 (for reference today 97% of the waste are disposed to landfills that do not meet sanitary requirements, the percentage of waste processing by 2030 should reach 40% and 50% by 2050). Recycling and storage of industrial and municipal solid waste in full range should be provided. By 2050 Kazakhstan should build economy without waste, so-called "circular" economy.

Current trends in the energy sector in the world, including Kazakhstan are favorable for the use of different types of renewable energy resources. One such species is the biogas, which is produced by the decomposition of organic matter, particularly in the landfills of municipal solid waste (MSW).

Kazakh National Technical University named after K.I. Satpaev offers energy technological complex consisting of complex technologies of the use of energy potential of landfill, as well as an additional independent source of energy to serve the needs of the local landfill - solar systems.

Technology of power use of MSW developed by our group proposes to receive the

energy consumption in the form of briquettes and pellets, as well as biogas to generate electricity, heat and cold.

It should be noted that there is a tendency in Kazakhstan (for example, landfill Karasai Almaty) to increase the proportion of the paper fraction of MSW and plastics, and composite materials duplicated by almost 30%. While developed countries have stabilized the content of these components, which is caused by implementation of the new policy in the formation of waste, improvement of the culture of production and consumption, aimed at reducing the consumption of natural resources.

With the development of socio-economic infrastructure of the metropolis there has been a change in the morphological composition of MSW. The highest percentage of MSW accounts for waste paper (27.0) and food waste (23.0), the lowest - in the rubber (1.0), bone (0.2) and the skin (0,1).

In the article authors describe technology of obtaining energy fuel from MSW directly in the form of pellets and briquettes. According to technological scheme the preference should be given to granulated form of fuel.

Also technology of obtaining and use of biogas from MSW landfills is described by steps in the article. The inclusion of solar system for the energy intensive use is provided as additional technological step.

S.S.Nurkeyev

INTEGRATED RECYCLING OF MINERAL PART OF EKIBASTUZ COAL INTO ALUMINUM OXIDE, ALUMINIUM SALTS, FERROSILICON AND CEMENT

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Steam thermoelectric power stations in Europe, USA, China and India are put into operation on a large scale owing to large coal reserves in the world and price stability for it. As predicted by the International Energy Agency, in the nearest decades, coal will retain its role in Europe and in the whole world.

In the Republic of Kazakhstan, electric power is produced by 14 high-power thermoelectric power stations, where mainly Ekibastuz coals are fired. Further development of heat power engineering of Kazakhstan is based on the firing of Ekibastuz coals. Recently, the Senate of the RK Parliament ratified the Intergovernmental Agreement between Kazakhstan and the Republic of Korea On Construction and Operation of Balkhash Thermoelectric Power Station. Commissioning of block I of module I (660 megawatt) is planned in October 2017, and of the whole module I (1 320 megawatt), in April 2018.

The abovementioned Law is very important from the point of view of power safety of the Republic of Kazakhstan, because construction of the power station ensures the required power reserve in southern Kazakhstan.

The coals of Ekibastuz basin, which reserves amount to over 11 billion tons, contain

up to over 50% of ash; over 15 million tons of ash is emitted at the operation of only two Ekibastuz state district power stations, and over 2 million tons will be emitted after the commissioning of the Balkhash power station. The ash of Ekibastuz coals contains SiO_2 (~50%) and Al_2O_3 (~30%). At that, it consists of chemically stable components in the forms of mullite and quartz. Such ash is highly abrasive that result in high abrasive wear of boiler heating surfaces. This ash is keroid that causes poor trapping in wet Venturi scrubbers; besides, it is high-resistant that leads to inefficiency of electric filters. The consequence of this process is the atmospheric pollution by untrapped silicon dioxide ash. Due to the lack of binding components in the ash, no solid crust is formed at ash dumps, and dust is raised in the wind, thus causing secondary environmental pollution with already trapped ash. At the same time, a mineral part of fuel contains such valuable components as aluminum, iron and other metals as well as rare earth elements, rare and dispersed elements, for the production, delivery and refining of which much funds are spent in the metallurgical industry.

During several years the Kazakh National Technical University after K.I.Satpayev has been developing scientific basics and technologies of integrated recycling of aluminum-containing ash slag of Ekibastuz coals, which can be a source of aluminum salts, aluminum oxide, ferrosilicon, rare metals and other products for the economy.

The studies conducted with regard to the creation of scientific basics and technologies of alkaline and acidic methods that can propose new technical solutions and methods of integrated recycling of alkali-free aluminum-containing raw materials. Cost effectiveness of these methods was determined by means of comparing of the existing or already applied technologies. At that, results of research works and semi-commercial tests as well as the actual data of operation of non-ferrous and chemical companies have been used. They included the following methods of integrated ash recycling: alkaline method of recycling of self-disintegrated slag, acidic technologies of integrated recycling of ash slag of Ekibastuz coals, sulfuric acid method, nitric acid method, hydrochloric acid method.

P.D. Pavlov
M.V. Reshetnikov
V.N. Eremin

POLLUTION OF SOILS BY HEAVY METALS IN A ZONE OF INFLUENCE OF GROUNDS OF MUNICIPAL SOLID WASTE' BURIAL

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Due to the accelerated rates of an urbanization the question of safe burial and utilization of the municipal solid waste (MSW) is particularly acute. In the territory of the Russian Federation the main method of waste disposal is creation of solid waste landfills. Within the Saratov region there is a number of grounds of MSW' burial which are potential sources of the polluting substances in environment.

Compounds of heavy metals are distinguished from the polluting substances coming to environment from functioning of grounds of burial of MSW in separate group. Heavy metals from which it is possible to distinguish, lead, cadmium, mercury, arsenic and others, constitute real danger including to a soil cover of territories, adjacent to grounds. Within the undertaken researches soils of the territories which are in a zone of influence of grounds of MSW' burial were studied: Guselsky (Saratov), Aleksandrovsky (Saratov area) and the Balakovo (Balakovo).

Territories of all surveyed grounds are located in various geological and geomorphological conditions. The Guselsky ground occupies a watershed surface, Lower Cretaceous clay deposits serve as soil-forming breeds. The Aleksandrovsky ground is located on the watershed surface put by Upper Cretaceous sandy deposits, and the territory of the Balakovo ground represents the Volga River terrace put by quarternary loamy deposits. The geological structure and geomorphological conditions in many respects predetermine migratory abilities of heavy metals.

In close proximity to grounds, taking into account a geomorphological and geological structure, and also climatic conditions, tests of soils were selected: in the territory of the Guselsky ground - 44 tests, Aleksandrovsky - 41 tests and Balakovo - 60 tests. In all tests concentration of mobile forms of heavy metals - cadmium, lead, chrome, nickel, copper and zinc was defined by method of nuclear absorption. Results of analytical researches were compared with standard indicators (maximum concentration limit and UEC). As a result the excess of the content of heavy metals over standard indicators were established. For each ground geochemical ranks were defined: for the Guselsky ground - $Ni(mg/kg) > Zn(mg/kg) > Cu, Cr(mg/kg) > Pb(mg/kg) > Cd(mg/kg)$, for Aleksandrovsky ground - $Ni(mg/kg) > Zn(mg/kg) > Cr, Pb(mg/kg) > Cu(mg/kg) > Cd(mg/kg)$, for Balakovo ground - $Ni(mg/kg) > Zn(mg/kg) > Cu(mg/kg) > Cr(mg/kg) > Pb(mg/kg) > Cd(mg/kg)$.

Thus, it was established that the studied grounds of burial of MSW are the main sources of receipt of compounds of heavy metals in environment, including in a soil cover of the territories applying to grounds to which the notable damage is caused. The last, undoubtedly, needs in the suction actions, first of all in the territory adjacent to the Guselsky ground used for agricultural production.

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N.A. Ivashchenko

BUILDING MATERIALS MADE OF INDUSTRIAL WASTE

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Developing building and construction materials with specified properties is one of the major problems in contemporary materials science. The issue has two main aspects: material science and technology. The first aspect provides an establishment of the quantitative relationship between composition and structure of materials and their properties, and also a discovery of patterns in property changes of materials to be used. The second aspect

relates to technological maintenance of specified quality indicators. The solution of these problems belongs to the methodological approach, which considers building composites as material systems organized in a complex way. Qualitatively new stage in the development of unified theory on structure formation and properties of highly structured material systems is a fundamental scientific doctrine in the field of construction materials science, synergy, physical and colloid chemistry, and mechanics of heterogeneous structures. The theory benefits to our understanding of the processes occurring in multi-level structural composition of materials at all technological stages. Environmental issues related to the resource saving energy efficiency advance in the building materials industry. Demand for different binders and fillers for concrete and mortar increases continuously, which accounts for the relevance of these issues. We need more complete and comprehensive use of mineral resource reserves. Those include a variety of industrial waste. Guidelines on using various industry waste materials as binders, mineral fillers, and active modifying additives have an experimental and theoretical foundations. Various compositions of mixed binding agents have been developed, such as gypsum cement, pozzolanic additives, slag-alkaline cement compositions, sodium silicates, furan and other binders using solid mineral waste as finely dispersed fillers obtained by grinding the concrete scrap, various glass materials, calcium hydrogen phosphate dihydrate, pickling sludge, and ferrous slag metallurgy. Additionally, the composite technology approach, which provides a fairly wide range of building materials for various purposes in industrial and civil engineering and road construction, has been developed. However, the subject of the reviewed issue requires further consideration.

A.P. Pesterev

THE RESULTS OF WEST YAKUTIA CRYOGENIC SOIL RESEARCH

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The western part of Yakutia in the natural relation is the richest in reference to republic biomass productivity and various in the species composition of plants and animals. Currently, there oil and gas fields have been intensively developed and operated. Mining accompanied by widespread forest clearing for construction of infrastructure of exploration, mining, transport and servicing industries. During the oil and gas-mining works slurry earth storages are built, there are oilfield brines disposal, various toxic chemicals for slurry are used, there are also accidental spill when transporting, leading to pollution of territories. Annealing of associated gases and accidental spill that is fraught with emergence of the extensive forest fires causing degradation of a cryolithozone, which are shown in subsidence of a relief owing to thawing of underground ices, bogging, solifluction, thermoerosion and others cryosolic processes. Thus, mining is interfaced to a complex of negative effects on natural landscapes of a cryolithozone. Thus considerable

transformations are noted in the vegetative ground cover and directly reflected other components of ecosystems too. The western Yakutia occupies east half of the Siberian platform. The dominating relief types there are structural denudation sheeted and step plateaus in combination with accumulative low plains. Breeds of the lower Cambrian participate in a geological aspect of the called structures on which breeds of the Cambrian, the Ordovician and coal-bearing strata of Perm lie. All these breeds are intruded by sheeted and diagonal bodies of bazit. Breeds of the Cambrian and the Ordovician are covered by continental and marine deposits of Lias. The territory of the studied area on soil-geographical regionalization belongs to the Yakut East Siberian taiga small valley province, to the Srednelensky area. On forest vegetation regionalization the studied area enters to the Leno-Vitimsky foothill district of the Southern Yakut mid taiga forest vegetation province of the pine and larch taiga with participation of dark-coniferous forests. At research of the territory of the Western Yakutia we applied the conditional line of a transect passing perpendicularly to the bed of the river and covering all elements of a relief from the valley to watershed spaces. In the course of the works so far as from valley part of the Lena River to a watershed under the mixed woods cryosolic gray forest soils were found. The following studied type of soil is the cryosolic burozem in the even land. The paradox is that in a boreal (moderate and cold) bioclimatic zone of Yakutia in the conditions of massive irradiation of permafrost the types of soil of the subboreal (moderate and warm) zone are revealed. These soils weren't included into L.G. Elovskaya's classification (1987) and are not studied in cryosolic area. According to classification of soils of Russia (2004) they belong to rang of structural and metamorphic soils. So, cryosolic gray soils are formed under the mixed forest of small-leaved deciduous species in continental climatic conditions on the ancient alluvial deposits. Cryosolic burozems are formed more widely under the highly-productive needle-leaved multilayered forests on the pleistocene-holocene deposits.

In fact human intervention on taiga ecosystems recently increased in the republic and there is a danger of destruction of unique soils.

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S.A. Dubrovskaya
S.Y. Noreika
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ABOUT A PROBLEM OF POST-INDUSTRIALISATION OF SALT-MINING EUROPEAN TOWNS

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Up to this day salt mining remains an important but a rather isolated branch of industry. The special status of this industry has had its effect on the town development in different European countries. Due to difficult technological conditions of salt mining and activation of karst and erosive processes, salt mining in these towns is becoming more and more complicated. In this regard, the specialization of these towns is further

and further transforming into a tertiary industry, i.e. the use of tourist, balneological and recreational resources.

Nowadays, one of the most important problems in the sustainable development of small towns in Europe which were earlier involved into salt mining is a gradual withdrawal from a mining specialization and expansion in the exploitation of their recreational resources. Towns like Lüneburg (Germany), Wieliczka (Poland), Cardona (Spain), Hallstadt (Austria), Turda and Praid (Romania) Solotvyno (Ukraine), Sol-Iletsk (Russia) acquire post-industrial characteristics leading to a combination of problems connected with a change in the management and planning of urban lands.

In spite of differences in the formation of urban settlements, salt mining conditions and techniques, the similarities in general tendencies make it possible to put these towns into one group. One of the pioneers in the creation of a tourism and recreation cluster was Lüneburg in Lower Saxony that reoriented fully towards a service industry. Lüneburg now has the German Salt Museum, a health park, a sports and fitness centre and several natural monuments including the mountain of Kalkberg.

Among towns which emerged due to salt mining and are now famous for recreation, it is necessary to single out Wieliczka in Poland. While being popular among visitors of salt mines, the town also boasts a balneological resort.

As opposed to the towns of Lüneburg and Wieliczka, Cordona in Spain combines the attraction of the natural park “La Cordona” with the underground salt mining. The recreational importance of the Cordona mines lies in the unique adits with carnalite, sylvinite and halite deposits. Karst and erosive processes have an important impact on the work of the natural park.

An example of irrational nature management can be demonstrated by Solotvyno’s salt lakes in Ukraine, where the combination of the underground salt mining and recreational use of underground shafts has led to an activation of karst formation and destruction of the resort.

The use of salt mines for tourism and resort purposes is widely spread in Romania. The towns of Turda and Praid are turning into popular centres of tourism in Eastern Europe.

In Russia, an actively developing centre of tourism is Sol-Iletsk, situated next to the border with Kazakhstan. The salt has been extracted here since the mid 18th century. The most important tourist attraction is a former quarry filled with water as well as a group of mud lakes of karst origin.

This way, it is possible to observe a gradual post-industrialisation of salt-mining towns in Europe. In this process, it is utterly important to have a gradual transition and preserve the unique properties of salt mines and karst lakes, taking into consideration the positive experience of towns in Germany and Poland.

T.P. Platonova
A.P. Pakusina

CHEMICAL AND ENVIRONMENTAL CHARACTERISTICS OF MINOR RIVERS NEAR THE CONSTRUCTION SITE OF THE VOSTOCHNY SPACE LAUNCH CENTRE

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Minor rivers of the Amur region are affected by the mining industry, housing services and utilities and the agricultural sector. The Vostochny space launch centre is under construction. The most effective method of assessing the effect of the space launch centre on the environment and health of the population is the organisation of monitoring experiments during the construction. For this reason, the study of hydrochemical parameters of minor rivers in the proximity of the Vostochny cosmodrome is a critical task.

In June and September 2014 we studied the samples taken from the minor rivers in the Svobodnensky and Shimanovsky districts. The pH value in the rivers was between 7.220 and 7.701 in summer and between 7.391 and 7.964 in autumn, which corresponded to the norm. The total iron content in the Bolshaya Pera, Taldan and Ora rivers was 1.55 MAC, in the Urkan river – 2.8 MAC (MAC = 300 µg/dm³). The minor rivers Taldan, Seletkan and Bolshaya Pera contain 2-3 MAC of silicate-ions (MAC=10 mg/dm³). In summer, we found no ammonium nitrogen in the minor rivers Golubaya, Bardagonka, Malaya Pera, and small amounts of ammonium nitrogen in other samples (<0.20 mg N-NH₄/l). In autumn, the ammonium nitrogen content in the Bolshoi Never was 0.51 mg N-NH₄/g. No nitrites were found. We determined a minimal nitrate content in the rivers (<0.30 mg N-NO₃/l in June, < 0.02 N-NO₃/l in September). Orthophosphates were present in small concentrations (< 0.05 mg/dm³), with exceptions of 0.1468 mg/dm³ in the Bolshaya Pera and 0.1509 mg/dm³ in the Seletkan. No polyphosphates were determined. The waters of the minor rivers were saturated with dissolved oxygen to a considerable degree (between 78.8 % in the Taldan and 132.3 % in the Ora), the absolute value of the dissolved oxygen more than 6 mgO/l. The biological oxygen demand in 5 days, which shows the presence of easily oxidable organic compounds, in the rivers Golubaya and Malaya Pera in summer was very small – 0.6 mgO₂/l. In the Ora and Bolshaya Pera rivers near Ulegorsk the BOD₅ value was increased up to 3.8, which can be led back to the waste water discharge in the Shimanovsk area. A high BOD₅ value (2.3 mgO₂/l) in autumn was characteristic for the Bolshoi Never river, explained by the waste water impact of the Skovorodino town. The pollution of the Ora, Bolshaya Pera and Bolshoi Never rivers shows in high values of permanganate oxidation – 10.8 mgO/l. In other locations, the permanganate water oxidation was between 3.5 and 6.4 mgO/l. The contents of lead (<0.660 µg/dm³), cadmium (<0.032 µg/dm³) and chrome

(<2.866 $\mu\text{g}/\text{dm}^3$) did not exceed MAC. The copper concentration in the rivers was no more than 6.21 $\mu\text{g}/\text{dm}^3$ (the Bolshaya Pera), which exceeds MAC for fishery (MAX= 1 $\mu\text{g}/\text{dm}^3$). The cobalt concentration was between 12.284 $\mu\text{g}/\text{dm}^3$ in the Bardagonka and 39.642 $\mu\text{g}/\text{dm}^3$ in the Ora, which was also larger than MAC for fishery (MAC= 10 $\mu\text{g}/\text{dm}^3$). The zinc concentration was between 1.3 MAC in the Malaya Pera and 3.2 MAC in the Ora. The concentration of manganese ions Mn^{2+} in the Ora was 4.8 MAC, in the Bolshaya Pera – 6.4 MAC (MAC= 100 $\mu\text{g}/\text{dm}^3$). In other samples, the concentration of manganese ions Mn^{2+} was between 53.6 $\mu\text{g}/\text{dm}^3$ in the Golubaya and 92.964 $\mu\text{g}/\text{dm}^3$ in the Grishkin Kluch, which exceeds MAC for fishery (MAC= 1 $\mu\text{g}/\text{dm}^3$).

This way, minor rivers on the examined territory next to the Vostochny space launch centre under construction can be regarded as clean. The rivers Bolshaya Pera, Ora and Bolshoi Never experience anthropogenic stress. Our research can serve as a basis for further studies of anthropogenic stress on water bodies.

A.L. Podolsky
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URBAN AREA PROXIMITY VERSUS SOIL ECOPHYSIOLOGICAL CONDITIONS

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Ecophysiology of suburban soils is a bioindicator of environmental conditions in adjacent cities. To test this hypothesis, we designed the three-year comprehensive study of soil ecophysiological conditions along the gradient “city limits – core of the natural protected area, Kumysnaya Polyana” near the city of Saratov. The following thirteen ecophysiological variables were sampled: soil acidity, soil contamination with heavy metals (lead, copper, zinc, cadmium) and nitrogen-containing compounds (nitrates, nitrites, ammonia), soil respiration, soil enzymatic activity (urease, catalase), and soil microbial community composition (heterotrophs, micromycetes). An importance of the ecological assessment of this 44- km^2 natural protected area (NPA) is emphasized by the fact that it functions as a biodiversity reserve and favorite recreational location for the city residents.

Soils are known for long-term accumulation of contaminants, which makes them a valuable bioindicator of the overall environmental conditions. We selected four research locales within the NPA adjacent to the city areas with various levels of pollution impact due to different traffic intensities, and presence of industrial enterprises and private garage cooperatives. At each locale, we chose three sampling areas based on proximity to the city limits: adjacent (up to 0.5 km), medium (1 km), and remote (1.5 km). Within each of 12 sampling areas, we obtained soil samples using the “envelope” method. All collected samples were analyzed three times using standard procedures [Tepper et al., 2004; Haziev, 2005; Scholz, 2006] for each of 13 ecophysiological variables, resulting

in the database of 792 measurements of soil ecological condition. Statistical processing of the data, including calculating the standard error of the mean, and one-way and two-way ANOVA analyses, was conducted using the software package Minitab (version 16.2.2). As a result, proximity-dependent and spatial-variation-dependent trends of ecophysiological variables' dynamics were identified as well as possible interaction of the both was investigated.

Soil acidity was found to be approximately neutral (7.11 ± 0.11 to 7.27 ± 0.13) and did not vary statistically significantly among locales and among proximity areas ($P = 0.6$). Nitrogen-containing compounds were detected below maximum permissible concentrations (MPC). Their concentrations were decreasing 1.3–21.7 times with the distance from the city limits ($P = 0.001$), which could imply that vehicle exhaust gases were their major pollution sources for soils.

Heavy metals' concentrations in soils were found well below MPC-values, significantly decreasing 2.4–4.2 times with the distance from the city ($P = 0.001$). While we did not find any statistically significant spatial variation trends for copper ($P = 0.3$) and zinc ($P = 0.1$), cadmium and lead concentrations significantly varied among the locales ($P < 0.001$). However, two-way analyses of variance of the interactions among the proximity variation trends and spatial variation trends yielded highly significant probability values ($P < 0.001$) for cadmium and lead. This finding could be accounted for by the presence of lead industrial pollution sources and garage cooperatives at two locales of the study area out of four. In the latter case, garage owners burn cadmium-containing worn-out tires and improperly dispose of cadmium-containing batteries at unsanctioned waste sites on a regular basis. Traffic jams near those locales could be another possible pollution source.

Rates of soil respiration and soil urease and catalase enzymatic activities were found to be statistically significantly increasing 1.1–4.9 times along the city limits-core of the NPA gradient ($P = 0.01$, 0.05 , and 0.01 , correspondingly). This finding confirms our hypothesis, that soil contamination from the city sources plays cause the major negative impact on the viability of soil microbial communities and intensity of their physiological processes.

As for microbial communities' composition, we have found statistically significant 1.5 times increase in heterotroph colonies' densities with the distance from the city limits ($P = 0.02$), while mycomycetes' numbers did not vary significantly with the proximity to the urban area ($P = 0.15$). At the same time, highly significant spatial variation in both groups of microorganisms was detected ($P < 0.001$), accounting for the differences in industrial impact from the urban areas adjacent to the locales. The outcomes of two-way ANOVA tests were highly significant too ($P < 0.001$), which supported the hypothesis of the city pollution sources' impact on soil ecophysiology.

E.G. Riabova

CALCULATING WEIGHT COEFFICIENTS IN THE MODEL OF ECOLOGICAL REHABILITATION OF RUSSIAN TOWNS AND MID-SIZED CITIES*The International University of Nature, Society and Man "Dubna",
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Nowadays urban environment is the basic human living environment. Today urban population in Russia amounts to 73, 86% and part of towns and mid-sized sites among all of Russian urban territories amounts to 85%. From there, any problem, connected with comfort and safety of urban environment, is actual and claimed immediately decisions. To estimate towns' conditions and their "hot points" was created the model of ecological rehabilitation, contains five main blocks (they are "Geomorphic data" block, "Environmental conditions" block, "Eco-economic data" block, "Socio-economic data" block and "Social data" block, containing two sub-blocks like "Medical-demographic data" and "Socio-psychological data"), each of them consist of separate elements, pointed this or that towns' problem. However to correct presentation of real situation, every element should have own weight coefficient, characterized the measure of significance this element in overall town picture. This way it's necessary to complete the task of choosing method of calculating weight coefficients for each element inside the model.

Today there are some methods of calculating weight coefficients are used, each of them has its own advantages and disadvantages. For this model of rehabilitation was chosen the Analytic Hierarchy Process (AHP), based to pair-wise comparison of all elements with special estimation scale, created T. Saati. Results of pair-wise comparison casted in the form of square antisymmetrical matrix. The process of calculation of weight coefficients was accomplished in 'MathCad' program by way of taking eigenvectors of matrix, conforming to weight coefficients of elements inside the model. Verification carried out of norming method. As a result, after calculating will received the weight coefficients as for elements inside the each block as for all elements inside the whole model. Besides that was calculated the own "weight" of each block. Therefore, the weight of "Geomorphic data" block consists of 0,216; the weight of "Environmental conditions" block is 0,471; the weight of "Eco-economic data" block is 0,330; the weight of "Socio-economic data" block is 0,588; and weight of "Social data" block is 0,527 (primary at the cost of "Medical-demographic data" sub-block).

For the further research from each block were selected for five elements, mostly with the highest weight coefficients, characterized every part of town conditions. For "Geomorphic data" block they are: natural hazards ($w = 0,587$); landscape ($w = 0,570$); geology aspects ($w = 0,259$); microclimate ($w = 0,259$); and hydrological system ($w = 0,259$). For "Environmental conditions" block they are: green plantings area per one citizen ($w = 0,330$); the air pollution index ($w = 0,307$); the water pollution index

($w = 0,270$); the ecological soil quality loss index ($w = 0,234$); waste volume per year ($w = 0,181$). For “Eco-economic data” block they are: recycling ($w = 0,698$); industry resource intensity ($w = 0,451$); “green” technologies ($w = 0,404$); alternative energy ($w = 0,293$); and energy consumption ($w = 0,209$). For “Socio-economic data” block they are: social objects availability ($w = 0,623$); employment of population ($w = 0,531$); housing services and utilities availability ($w = 0,355$); transport availability ($w = 0,344$); and average wage ($w = 0,220$). And the last, for “Social data” block were selected seven elements (five for “Medical-demographic data” sub-block and two for “Socio-psychological data” sub-block). They are: child mortality ($w = 0,551$); child morbidity ($w = 0,438$); birth rate ($w = 0,404$); population growth ($w = 0,375$) and number of pathologies ($w = 0,324$). And also two main psychological elements: the satisfaction of habitat quality ($w = 0,545$) and ecological education ($w = 0,319$).

In future work is planned to describe environment urban conditions of seven selected towns and compare the results with the existed characteristics of these towns to find are the weight coefficients correct.

K.A.Romanova

MODEL WASTE MANAGEMENT OF PRODUCTION AND CONSUMPTION AT THE REGIONAL LEVEL

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The waste management strategy is a modern expression used in many phrases, and not always correctly. However, this expression should be taken very seriously because of the mountain of waste continues to grow and grow, and we have something to do.

What is waste?

Components of the waste have the same molecular basis as other goods and products. Any chemical difference between them is missing.

Waste differ from other goods and products, at least for 3 reasons:

- waste does not have economic value or the value is very small compared with conventional products;
- waste can be dangerous due to their location and shape;
- waste often are a mixture of very different products.

Production in the economy follows a linear pattern.

Management system waste management need to convert this linear scheme in the circular, circular diagram, including economic, biological cycles, cycle energy recovery and disposal of waste.

1. The economic cycle Secondary raw materials:

1.1 Organic waste: solvents, sugars, proteins from the processes of the chemical enterprises.

1.2 Inorganic waste: ferrous and nonferrous metals, sulfur of metallurgy, Metalworking and chemical industries and domestic waste: «Secondary» transformed materials:

1.3. Binders for hydraulics: fly ash, lime sludge from steel, metallurgical and chemical enterprises.

1.4. Glass: bottles, broken glass in domestic and industrial waste.

1.5. Plastic: PVC skin, polyethylene terephthalate, polyethylene and other companies for the production of plastics, household waste and commercial packaging.

1.6. Paper and cardboard: paper, packaging from manufacturers and household waste.

1.7. Tires: the tires of the automobile industry, workshops and household waste

Environment :

1.8. Water purification: sulfates and other substances from industrial enterprises

2. Biological cycle

Breeding crops:

2.1. Organic fertilizers like Compost, manure, settling sludge and other agricultural and industrial waste

2.2. Mineral fertilizers Potash, slag, chalk from the mining, steel and chemical plants. Agricultural products:

2.3. Foods of animal origin Kitchen waste, waste from slaughter and waste of enterprises for the production of agricultural food products, restaurants and other

3. Cycle energy recovery

3.1. Burning of Household waste, non-hazardous municipal waste and non-hazardous waste enterprises

3.2. Fuel derived from recycled materials Plastic, wood waste (after conversion)

3.3. Pyrolysis waste containing wood

3.4. Biogas Organic matter

4. Neutralization, stabilization

4.1. The incineration of Hazardous waste, hospital waste, liquid waste from industrial enterprises, agriculture and municipalities

4.2. Physical and chemical neutralization of Hazardous waste (acids, alkalis, etc.) from chemical plants, and other electrogalvanic

4.3. Biological treatment of Wastewater, contaminated soils from municipalities and industrial enterprises

4.4. Stabilization of Residues from gas cleaning, sludge, fly ash processing in other ways

5. Delete

5.1. Sanitary disposal of Elementary waste

5.2. Disposal of hazardous wastes Elementary waste

5.3. The disposal of inert wastes Elementary waste

On the basis of the cyclical scheme of waste management we propose a model of waste management of production and consumption at the regional level, which includes all stages of waste management: collection, transportation, recycling, disposal of waste, maximizing economic efficiency and minimizing negative impacts on the environment.

A.E. Rylskii

O.V. Borush

AIR CONDENSERS AS AN ALTERNATIVE MEANS TO A TRADITIONAL WATER SERVICE SYSTEM

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Nowadays, the using of traditional systems for emission steam cooling is getting problematic and in some cases even impossible because of the requirements of increased environmental conservation and sustainable use of water resources.

The using of traditional schematics, chilling water passing through trickling cooling plants, often cause high humidity in the area of the power plants functioning. Because of that there is a high level of damp fog, which in conjunction with the Russian harsh weather conditions, especially in such places like Siberia, lead to the freezing of equipment as well as a loss in reliability of their operational activity. Besides that, the rejection of condensation by water discards the necessity of laying additional water pipelines in thermal power plants which allows the possibility to save water and money.

As an alternative means to a traditional water service system, it is also possible to use air condensers as part of a steam-operated power plant.

An air cooling system provides an opportunity to reduce the level of environmental impact, this will alleviate withdrawal-consumptive water use and rectify the problem of sediment formation in the heat-exchange equipment and to raise the reliability of the equipment. The utilization of such technology would mitigate the use of water-intake and water-treatment facilities, trickling cooling plants and other waterworks systems.

It should not go unmentioned that there are a lot of regions where an alternative to air condensers does not exist. In regions that have water shortages, power plants that are built with air condenser technology, which do not depend on water resources, will be a tremendous advantage.

The use of air condensers is inevitable, already such countries as the US, Germany, China, and Canada are developing ways to advance the efficiency of air condensers and apply them practically and successfully. Unfortunately, Russia is behind on developing the technology and it does not give due consideration to the benefits of the technology.

The most common version of an air condenser is the A-type modular structure and it is most suitable for producing power units with different capacities.

The steam duct through which the turbine exhaust steam is transferred to the air-cooled coils runs horizontal to the point of rising to the condenser inlet headers. The condenser

tube bundles are installed in A-type frames on the condenser platform. Only the parallel flow bundles are directly welded to the inlet steam header located on top of the bundles. The steam enters these bundles and flows downward parallel with the condensation to the bottom condensate header which runs along the bottom inside the A-type structure. The excess steam is carried through the condensate and flows upward, countercurrent to the condensate, through the dephlegmator bundles. The noncondensable air is evacuated from the top of the dephlegmator bundles. The dephlegmator bundles are located toward the center of the unit to assure maximum symmetry in the steam distribution. The hot condensate flows by gravity to the hot well tank.

According to the GEA specialists' research the cost of the air condenser units is 80-100% of the cost of recycling water supply with the surface condenser. Furthermore, the electric energy consumption for the fan drive group approximately equals the condensing-water pumps. The comparative evaluation of the commercial efficiency of the air condenser usage allows to conclude that the using of this equipment has more advantages than a traditional water service system.

Therefore, the elaborate study of the application, together with the effectiveness analysis of a steam power plant with an air condenser in the Russian weather environment is very important and in high demand.

T.Z. Rysbekov
S.T. Rysbekova

ECOLOGICAL TOURISM AND PERSPECTIVES OF ITS DEVELOPMENT IN KAZAKHSTAN

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In recent years alternative directions of using natural resources are searched in connection with the worsening of environment. One of such new directions is the ecological tourism. There are 2 main approaches to the separation of ecological tourism sector: 1. Eco-tourism is tourism, the main object of which is the wild nature, in which widespread tourism to rest on nature territories, forested by man. 2. Ecological tourism is an example (type) of a sustainable tourism. This tourism including all forms of nature tourism in which the main motivation of the tourists is the observation and connection to nature. In this approach, the objects of tourism can be both natural and artificial origin.

Ecological tourism (ecotourism) is the most perspective field, which is developing in different countries of the world, including in the Republic of Kazakhstan. The Republic of Kazakhstan has its own unique natural and climatic features, and the great number of natural and historical monuments related to various genetic varieties and historical epochs.

A very important moment in the development of tourism in the Republic of Kazakhstan

is to develop a framework of sustainable recreational use of nature, which should cover at least two mechanisms of protection of natural environment: 1) legal containing the system of the environment (standards, bans, sanctions and the like); 2) economic (self-financing paid nature management based on the principle of compensation of losses in natural resource management).

In the framework of the developed Concept of development of tourism until 2020 competent authorities strive to increase the share of tourism in GDP of the country to more than 4%, private investment in the industry - up to 4 billion dollars with the creation of up to 300 thousand jobs. In General, the concept provides for the development of five tourism clusters of countries in Astana, Almaty, Eastern, Southern and Western Kazakhstan. While Astana and Almaty are positioned as the center of business tourism, Almaty - also as a center of international mountain tourism. Within a cluster "Eastern Kazakhstan" is planned to create a centre for ecological tourism development. In southern Kazakhstan want to develop cultural tourism, and the West, cultural and beach tourism. In these clusters, provides for the implementation of national projects: ski resort South Kaskelen and Kok Zhailau - in cluster "Almaty", Bukhtarma and Katon-Karagai - in cluster "Eastern Kazakhstan" Kendirli - in the cluster "Western Kazakhstan" Burabai in the cluster "Astana". In the coming period to clean lakes of Kazakhstan will be allocated more than one trillion tenge which readjustment will be subject to 18 lakes of the republic. Thus, conditions, opportunities and potential for the development of ecological tourism in Kazakhstan there. The systematic and comprehensive work is need in this direction at the appropriate level, serious, scientifically based, including long-term projects.

I.S. Selezneva
M.A. Bezmaternyh
E.F. Vaysulova

BIOLOGICAL PURIFICATION OF AQUEOUS WASTE MODERNIZATION

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Power inputs lowering for different technological processes is a very actual problem. Waste-water treatment in the North aeration station (NAS) of Yekaterinburg city is carried on a high level. But waste-water treatment is power-intensive, and power expenses are the main cost-based part in the waste-water treatment technology.

Electric energy demand lowering, which is required for intensive aeration in the aerotank, is one of the main energy saving directions in the NAS. In this scientific work we offer to substitute Hafi membrane aerators, which are functioning in the NAS now, by more effective Bakor ceramic aerators. They are different geometric pattern plates, permeable for gas. The plates are produced from nanomodified highly porous ceramics with porous size of 100 μm . This construction does not demand any special fastening in the aerotank, connecting pipe is situated directly in the aerotank. Aerators' assembling is anticipated into the existing air pipes.

The advantages of Bakor aerators include:

- they are easy to maintain
- it's possible to carry out local repairing of separate units, including replacement of aerators without stopping operating mode in the aerotank
- durability
- ecological safety
- aerators working surface is easily regenerated if necessary and aeration system is water-proof in the absence of air pressure in the system.

Bakor aerators provide small-bubble aeration (the size of bubbles is 0,5...1 mm, the amount of bubbles is increased by a hundred times) with a lower air consumption.

Currently Aerzener GM 80 blowers with variable frequency drive of nominal capacity of 132 kW are being used at the station. The number of the blower engine revolutions is regulated by CombiVario CV-7600 frequency regulator from the signal of the meter of dissolved oxygen content in aerotank. As the consumption of air for the aeration purposes is reduced, it is possible to lower the capacity of the blowers used by 50 % with the help of frequency regulator. The decrease of energy consumption will be 301,98 reference fuel tones / year.

The efficiency of replacing Hafi membrane aerators by Bakor ceramic aerators was calculated and it was found out that energy intensity of waste waters biological purification will be reduced by 0,011 reference fuel tones /thousand cubic meters, which is 50,0 %.

Suggested replacing of membrane aerators by the new aerators made of nanomodified ceramics will give a considerable energy saving effect, which will figure up to 5383,38 thousand rubles a year in money terms.

Due to selling the retired membrane aerators at depreciated cost, it's possible to cut expenses for modernizing aeration system. Payback period of additional capital investments will be about a year.

V.S. Semenishchev
A.V. Voronina
E.V. Nogovitsyna

A NEW SORBENT FOR CAESIUM SEPARATION IN LIQUID RADIOACTIVE WASTE TREATMENT AND RADIOCHEMICAL ANALYSIS

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Due to extension of atomic energy in Russia and planning of realization of closed nuclear fuel cycle, problems of liquid radioactive wastes treatment become more important. Radiochemical analysis of anthropogenic radionuclides in various environmental samples (e.g. Cs-137 and Sr-90 in drinking, sea and ground water, food, etc.) is also of great interest. The method of synthesis of surface modified nickel-potassium ferrocyanide based on hydrated titanium dioxide (T-55 sorbent) for concentration of caesium from aqueous media is developed by Radiochemistry and Applied Ecology chair of Ural Federal

University. Comprehensive tests of T-55 sorbent using physical-chemical methods of analysis as well as determination of its sorption features are made. It is shown that the sorbent possesses high radiation and chemical stability, high porosity and specific area, selectivity to Cs, specificity to Sr. For example, Cs distribution coefficient from tap water is as high as $(4.0 \pm 1.0) \cdot 10^5 \text{ mL g}^{-1}$ and static exchange capacity of Cs is up to 270 mg g^{-1} . The sorbent also allows simplifying the scheme of liquid radioactive wastes processing due to combination of sorption decontamination of liquid phase and immobilization of caesium and strontium radionuclides in the same stage.

It is shown that T-55 sorbent can be used for preconcentration and separation of caesium with the aim of radiochemical analysis of various samples for Cs radionuclides. The sample was previously acidified with HCl to pH 1 – 2 (Sr, U and Th are not adsorbed at this pH) and passed through column. Good mechanical features of T-55 sorbent allow treating large water volumes. For example, in our experiments more than 120 000 bed volumes (B.V.) of tap water spiked with Cs-137 were passed through column with T-55 sorbent without any significant breakthrough (less than 3%) and sorbent destruction. This experiment was stopped because of high sorbent activity before column resource was exhausted; the maximal resource about 400 000 B.V. was calculated. This meant that 1 mL column with T-55 sorbent allows caesium preconcentrating from up to 400 L of water that will provide very low detection limit. Determination of Cs may be performed by measurement of either saturated sorbent or eluate (Cs can be eluted by a small volume of 5M NaOH) via gamma-spectrometry.

Also experiments have shown the slight influence of typical interfering ions for caesium. Among analogue ions (Na^+ , K^+ , NH_4^+) only ammonium ions at concentrations higher than 0.01 mol L^{-1} may suppress caesium sorption; however, even in 0.5M NH_4Cl solutions caesium distribution coefficients remains higher than 10^3 mL g^{-1} . The interference of sodium and potassium was not observed even at their concentrations as high as 0.5 mol L^{-1} .

Thus, due to its good properties, the T-55 sorbent allows successfully solving such important environmental problems as liquid radioactive waste treatment, safe immobilization of radionuclides with the aim of their long-term storage as well as preconcentration and separation of radiocaesium in scheme of radiochemical analysis of environmental samples.

V.S. Semenishchev
A.V. Voronina

MONITORING OF RADON ACTIVITY IN UNDERGROUND DRINKING WATER NEAR EKATERINBURG

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Quality of water resources, used as drinking and domestic water, becomes lower because of constant increasing of anthropogenic pressure on environment including hydrosphere.

Surface water (rivers, lakes, etc.) used in large cities as primary sources for centralized water supply is usually the most contaminated. For example, the quality of water in the greatest rivers of Sverdlovsk region varies from “contaminated” to “strongly contaminated”. Considerable part of citizens in most cities in Russia often uses alternative sources of drinking water because of very low quality of tap water. Underground water from boreholes and springs is one of popular alternative sources of drinking water; meanwhile such water may contain considerable amounts of natural toxic pollutants including natural radionuclides. Among natural radionuclides presenting in underground water the most contribution in radiation dose is connected with radionuclides of uranium and thorium families, mainly ^{222}Rn and in a less degree ^{226}Ra . For example, contribution of radon in average annual radiation dose for population of Sverdlovsk region (Urals, Russia) is 75 – 80%, whereas contribution of anthropogenic sources (excluding medicine) is not more than 0.01%. The presence of a number of radon anomalies (places with increased concentrations of radon in air and water, connected with uranium-rich formations) on Urals is aggravating factor of radiological risk. In accordance with Russian radiation standards maximum permissible activity of ^{222}Rn in drinking water is 60 Bq·L⁻¹. Determination of activity of ^{222}Rn in drinking water from underground sources is obligatory, but many individual and open-access springs and boreholes are not always analyzed for radon. In this work analysis of specific activity of radon in several most often used springs in Ekaterinburg city west outskirts, recommended by official site of Ekaterinburg, as well as in the main borehole in Palkinsky settlement. Monitoring of variations of radon activities in “Memory spring” was exercised from January 2013 to November 2013. Activity of ^{222}Rn in water samples were measured using low background ultra pure germanium semiconductor gamma spectrometer “GEM50-P4” via equilibrium ^{214}Bi (608 keV) in standard Marinelli vessel (1 L).

The analysis of water from natural sources has shown, that specific activity of Rn-222 in tested natural sources vary within 15 to 110 Bq/L. Water from one spring (“Memory spring”, 80 – 100 Bq·L⁻¹) doesn’t meet requirements on radon activity, therefore, it is not suitable for drinking. However, a lot of people (approximately 100 – 150 persons daily) get water from these springs for drinking. Specific activity of radon in water from other sources did not exceed limits. Monitoring of variations of radon activities in “Memory spring” was exercised from Jan. 2013 to Nov. 2013. Water flow discharge in this spring strongly depends on season and is 8 – 9 L/min in winter up to 25 – 30 L/min in spring and summer. It was supposed, that due to constant rate of generation of radon, decreasing of specific activity of radon because of dilution will be expected. Against expectations, the results have shown, that radon activity was almost constant and exceed maximum permissible activity during the whole year (insignificantly higher in summer), at the average 93 Bq·L⁻¹. This indicates that migration of ^{222}Rn with water from place of its formation in winter is approximately 3 times lower than in summer; this could be explained through decreasing of kinetics of this process at low temperatures.

Critical way of people irradiation by ^{222}Rn , presenting in drinking water, is transfer

of radon to air and further inhalation transfer of short-lived daughter radionuclides to lung. It was experimentally shown, that after boiling more than 95% of radon passes to atmosphere. For decreasing of radiation stress it is recommended to boil this water under kitchen extractor fan or to store it in a leak proof tare for decay of radon during at least several days. It was calculated, that after decay of $100 \text{ Bq}\cdot\text{L}^{-1}$ of ^{222}Rn in water $0.05 \text{ Bq}\cdot\text{L}^{-1}$ of ^{210}Pb will appear, that will not exceed maximum permissible activity ($1 \text{ Bq}\cdot\text{L}^{-1}$). Calculated annual dose due to consummation of this water will be only 0.033 mSv .

Vera Seredinskaya

ÖKOLOGISCHE FAKTOREN UND IHRE EINWIRKUNG AUF DIE ENTWICKLUNG VON KINDERN

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Die gesundheitliche Verfassung eines Kindes ist der beste Kennwert, der die Veränderung der Umwelt aufzeigt. Viele Studiendaten bezeugen, dass Regionen mit unfreundlichen Ökosystemen eine höhere Anzahl von Erkrankungen registriert, bei Erwachsenen wie bei Kindern. Dabei kann man eine Verbindung zwischen der Struktur der Erkrankung mit ihren regionalen ökologischen Besonderheiten, der Wirkung bestimmter Xenobiotika oder ihrer Kombination feststellen. Jedoch bereitet die Erkennung solcher Verbindungen ein schwieriges Problem. Für Ihre Lösung verwendet man eine Analyse, die viele Faktoren beinhaltet. Die Analyse schließt einen Vergleich von medizinisch-demographischen Messwerten eines Geländes und den Grad einer Überschreitung des Grenzwertes der Konzentration einzelner Klassen Xenobiotika in der Biosphäre, ihren Gehalt in den Biosubstraten, eine Analyse der Verbreitung funktionellen und klinischen Pathologie, die Ergebnisse einer prospektiven medizinischen Beobachtung an der Population mit hohem Risiko ein.

Über die Interaktion des Organismus eines Menschen mit seiner Umwelt hat der Begründer der russischen Physiologie I. Sechenov geschrieben. Er schrieb, dass "ein Organismus ohne Umwelt, die seine Existenz unterstützt, unmöglich ist, deshalb in der wissenschaftlichen Definition des Organismus auch eine Umwelt sein muss, die auf ihn einwirkt". I. Pavlov, der diese Position ausweitete, ist zu dem Schluss gekommen, dass man über einen Menschen, wie über einen unteilbaren Organismus reden soll, der eng mit der Umgebung verbunden ist und nur solange existiert, wie er im Einklang mit seiner und seiner Umwelt ist.

Folglich kann man einen Menschen nicht adäquat beurteilen, ohne einen Bezug zu der Umgebung in der er lebt, erzogen wird, arbeitet, zu den Menschen mit denen er Kontakt hat, die Funktionen seines Organismus; ohne der Berücksichtigung der hygienischen Anforderungen an seinem Arbeitsplatz, Zuhause, ohne die Berücksichtigung der Interaktion eines Menschen mit Pflanzen, Tieren usw. zu nehmen.

In der engen Verbindung mit der Verschmutzung der Umwelt befindet sich die Definition der medizinischen-demographischen Werte:

- Häufigkeit der Frühgeburt
- Abweichung vom Mittelwehrt der Maße des Körpers eines Neugeborenes
- Die Häufigkeit der Geburt von Kindern mit mehreren Anzeichen von Störungen der inneren Entwicklung
- Häufigkeit der Makel der Entwicklung und Chromosom-Krankheiten bei Kindern
- Häufigkeit der Anämie bei Kindern
- Frequenz der Pathologie der HNO-Organen
- Erhöhte Häufigkeit der "kontrollierbaren" Infektionen
- Häufigkeit und Charakter der allergiebedingten Pathologie bei Kindern
- Häufigkeit und außergewöhnliche klinische Erscheinungsformen chronischer somatischer Erkrankungen bei Kindern
- Entstehung neuer außergewöhnlicher Krankheiten und Syndrome
- Häufigkeit der Debität und Anomalität des Verhaltens bei Kindern
- Häufigkeit der onkologischen Pathologie bei Kindern
- Menge von Behinderungen bei Kindern

Man sollte ebenfalls den nicht unwichtigen Faktor nicht vergessen, wie das Mikroklima in familiären Verhältnissen während einer Schwangerschaft. Stress, die nicht rationale Ernährung einer zukünftigen Mutter, die soziale Nische (soziales Umfeld) in dem sie sich während der Schwangerschaft befindet. All das Aufgezählte kann zu einem fruchtbaren Boden für die Entwicklung der Pathologie bei einem Kind werden.

I.V. Sergeyeva
E.S. Sergeyeva

ECOLOGICAL-HYGIENIC ASSESSMENT OF RIVER QUALITY ON THE BASIS OF REGIONAL CHARACTERISTICS

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We consider modern approaches to the assessment of environmental quality of natural water bodies and provide information about condition of many rivers of the Saratov region. We used the chironomid larvae in assessment of the quality of surface water pollution in conditions of anthropogenic stress. Among benthic organisms, these larvae are particularly sensitive to water contamination.

As the objects of ecological and sanitary-hygienic analysis, we selected rivers that provide with water left-bank areas of the Saratov region, including dozens of settlements and places of recreation: Bolshoy Irgiz, Maly Uzen, Bolshoy Uzen and Yeruslan.

The geographical feature of the area is the availability of highly mineralized underground sources. Therefore, these rivers occupy a significant place in the drinking water supply for the local population and are an important component of water use for various purposes. River water is used not only for agricultural, industrial and domestic

uses, but also for recreational purposes. At present, the problem of controlling water quality in rivers and their safety remains relevant.

The Saratov region rivers undergo the disappearance of macrozoobenthos and changes in benthic species abundance: from abundant aquatic species to rare. On the other hand, we can observe the expansion of wide-spread species and the emergence of anthropophilic species. These changes can be indicators of lower quality, specificity and increased risk of stability loss by the biotopes under anthropogenic influences. Soil sampling for the detection of bioindicators was carried out simultaneously with water sampling for chemical and microbiological studies at the same control points.

Simultaneously with monitoring based on bioindicators, we tried assessing the degree of rivers' pollution using criteria of ecological condition. We conducted comprehensive evaluation separately for each harmfulness criteria: sanitary regime (SR) criterion, organoleptic properties (OP) criterion, toxicological hazard (TH) criterion, and epidemiological criterion (EC).

We carried out the calculations based on the values of the studied chemical, sanitary-epidemiological and microbiological indices: organoleptic parameters (turbidity, color, smell), the overall sanitary indicators (suspended solids, solids, pH, alkalinity, hardness, chlorides, sulphates, ammonia; nitrite; nitrate; dissolved oxygen; biochemical oxygen consumption), harmful substances that are listed on sanitary hazard standards list (zinc) and sensorial hazard index (iron, copper, petroleum products, surfactants), total microbial counts of aerobic and facultative anaerobic microorganisms.

Comprehensive analysis of water pollution level on harmfulness criteria reaffirms our conclusion about unfavorable hygienic status of Bolshoy Irgiz and Bolshoy Uzen rivers. Harmfulness criteria of SR and ST indicate moderate pollution: however, its values become close to high level pollution (3.0). The OP criterion values are quite high. For Bolshoy Irgiz and Bolshoy Uzen rivers, EC value for the entire study period was at the level of over 20, which indicates high level of pollution. In both rivers, there is a tendency to deterioration of water in all respects.

Relatively stable water quality was found in Maly Uzen river, without rapid pollution growth, which is confirmed by the results of integrated analysis of water pollution level according to the values of harmfulness criteria. Water quality deterioration tendency was observed in the Yeruslan river. *Procladius* (H.) *choreus* (Meigen) chironomid larvae were observed as a dominant species. They tend to tolerate a certain degree of chemical pollution of water.

Water quality deterioration tendency was observed in Yeruslan river. There we found the larvae of several species of Tanypodinae. Many tanypodins are tolerant to eutrophic waters. *Procladius* (H.) *choreus* (Meigen), tolerating high water contamination levels, was observed there in high quantities.

G.N. Sergeyeva

**DIGRESSION OF LANGUAGE AS AN ESSENTIAL PROBLEM
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The crisis that has targeted the world economy, interethnic relations and socio-cultural links cannot but reflect on language. General commercialization, removal of moral and ethical taboos, marginalization in the youth environment leave their traces in language usages, the culture of speaking going down, the standard principles and communicative qualities of speech being deformed.

The term “digression” used to be more often applied to natural sciences, since the processes of exhausting resources, negative changes, tilting the equilibrium were conventionally connected with the habitat and ecosystems. By now pollution, emasculation and decay have embraced both the sphere of culture as a whole and the field of language practice in particular.

The protection of language is becoming an urgent demand of the time. It should be realized not only within the framework of linguistics, lingo-ecology, but also at legal, political and socio-economic levels.

It should be necessary to mould the public opinion characterized by an intolerant attitude to vulgarization of speech, platitude in verbal communication and directed at tabooing obscene words; to enhance the degree of censorship in mass media; to develop a critical attitude to the quality of communication in social networks, etc.

Digression has stricken all the levels of the speech structure: vocabulary is undergoing irreversible processes of primitivization, idiom usages are being broken, norms of agreement are distorted, syntax is becoming commonplace, clichés and stock phrases are being overused.

The negation of language norm as such is supported by ersatz-patterns typical of the youth subculture. Natural laws of speech economy are transformed into complete absurd and a linguistic caricature. The desire to stylize, which is characteristic of a young generation in all times, the wish to oppose expressive, possessing some particular energy slang words to “dull, insipid” speech, the readiness to give a new understanding to the existed notions have outstripped the function of a game, a speech joke and like a virus have seriously hit the language system.

Ecological purification of a language should be a priority in matters of education: from a primary to a higher stage. The development of coherent speech, the replenishment of the vocabulary, the enlargement of semantic fields, the formation of an idiostyle include the possibilities of an explicit kind to reveal the intellectual potential of a personality.

The development of a man’s speech faculty does not end with his mature years, since a language is a living organism requiring an adequate reaction of its carriers to any

transformation, on the one hand, and incorporating the positive and negative dynamics of changing reality, on the other one.

Thus, bidirectional linguistic reality shows the inseparability of traditional ecology (the science dealing with interaction of living organisms and their communities between each other and the environment) and ecology of consciousness, psycho-ecology and language ecology.

N.L. Shapekova
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R.K. Tataeva

DISTINCTIVE FEATURES OF CHRONIC HEPATITIS C COURSE AMONG CHILDREN: CLINICAL AND PATHOGENETIC PARALLELS / MEDICAL BIOTECHNOLOGY

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Today, a significant part in the development of chronic liver diseases both among adults and children is played by viruses. A particular place in the structure of viral agents is occupied by viral hepatitis C or an HCV infection.

The aim of this research is to analyse epidemiological as well as clinical and laboratory parameters and effectiveness of the antiviral therapy on an example of a small group of children with chronic hepatitis C.

Based on the results of the epidemiological anamnesis, distinctive features of clinical and laboratory parameters and the therapy effect, it is possible to come the following conclusions:

1. The probability of a vertical transmission from a mother with chronic hepatitis C during the pregnancy is very high. This fact is confirmed by early laboratory manifestations (presence of high level of enzymes, RNA HCV) in 52.2% of children between 3 months and 4 years. According to the research data of foreign scientists, hepatitis C virus is able to replicate intensively – up to 10^{12} viral particles per day in the chronic phase of the infection [12, 26]. Biological properties of the virus and a favourable environment (physiological immunosuppression, intensive metabolism of the foetus) which occur in the organism of a pregnant woman can be optimal conditions for the vertical transmission of HCV.
2. The clinical and laboratory analysis of the children's condition confirms the absence of a correlation between the severity of clinical manifestations and laboratory parameters. The clinical manifestations are very scarce and are limited to the symptoms of general asthenization. Furthermore, laboratory parameters do not show any correlation between the high level of enzymes and RNA HCV, anti-HCV and viremia. The obtained results correspond to the data of many foreign and Russian scientists.
3. The evaluation of the effectiveness of etiotropic (antiviral) and pathogenetic

treatment with the determination of the remission character makes it possible to assume that the majority of children (75%) with HCV had a replicative mechanism of the disease course – direct cytopathic effect of the virus on the hepatocytes.

4. An induration in the portal and periportal zones detected during an ultrasound examination is a sonographic indication of the fibrosis development, which requires a further examination in order to specify the stage of the fibrosis and the correctional therapy.

S.E. Shcheklein
N.I. Danilov
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RENEWABLE POWER ENGINEERING APPLICATIONS IN THE DWELLING SYSTEMS DESIGNED FOR SEVERE CLIMATIC CONDITIONS

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An increasing interest to the use of renewable power engineering in Russia, which is associated with a considerable potential imparted by the vast territorial expanse of the Russian Federation, calls for impartial understanding of the technology capacities that enable achievement of the targeted functions to be performed by any energy-saving technology: adequacy and reliability of energy supply and cost-efficiency. Wider acceptance of the renewable power engineering applications is hindered with both the conservative skepticism demonstrated by veterans and unjustifiable optimism expressed by sophomoric enthusiasts. When implementing energy-saving projects, numerous mistakes can result from making averaged energy inputs-based calculations, from neglecting the deviations in actual environmental parameters, from disregarding the energy consumption diagrams, from misunderstanding and unawareness of starting currents and energy quality-related issues, from disregarding for sanitation and health safety regulations accepted for hot water supply installations, etc.

Experimental investigations into the efficiency of photoelectric installations, solar collectors and thermal pumps provide indications that, in the climatic zones of severe and acutely continental climatic conditions, power supply from renewable sources is deemed fundamentally unfeasible unless additionally combined with traditional energy sources.

Various embodiments are proposed for optimized combined generation of thermal and electric power using renewable power installations, which provide the lowest economic costs under the severe and acute continental climate conditions.

Svetlana Sheina
Liya Babenko
Anastasia Khatuntseva

**MANAGEMENTSYSTEM DER MEDIZINISCHEN
ABFÄLLE EINER KOMMUNE UNTER ANWENDUNG
VON GIS-BASIERTEN VERFAHREN**

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Die Sicherung des sanitär-epidemiologischen und ökologischen Wohlstandes der Bevölkerung ist in moderner Welt eine der vorrangigen Tätigkeitsrichtungen auf dem Gebiet des Schutzes der menschlichen Gesundheit. Insoweit nimmt das Problem der Handhabung medizinischer Abfälle einen besonderen Platz ein, da diese aus der epidemiologischen und ökologischen Sicht ein Gefährdungspotential aufweisen.

Seit 1999 wird in den therapeutisch-prophylaktischen Einrichtungen (TPE) in Russland ein separates Sammelsystem für medizinische Abfälle mit Zuordnung des Infektionsrisikofaktors den Abfallgruppen B und C gestaltet. Bis dahin wurden die medizinische Abfälle nur der chemischen Desinfektion am Entstehungsort unterzogen, die keine ökologische und epidemiologische Sicherheit leistet, die Gesundheit des medizinischen Personals der negativen Einwirkung des chemischen Faktors unterwirft und mit dem erheblichen Umfang von Desinfektionsmaßnahmen verbunden ist.

Seit 2011 werden die TPE Russlands durch neue Sanitätsgesetzgebung der RF [Sanitärtechnische Vorschriften und Normen (SanPiN) 2.1.7.2790-10 „Sanitär-epidemiologische Anforderungen an die Handhabung medizinischer Abfälle“] auf Einführung der zentralen und dezentralen thermischen Dekontamination von Abfällen der Gruppen B und C gerichtet.

Eben deshalb wird in vorliegender Studie die Gestaltung eines zentralen Entsorgungssystems für medizinische Abfälle der Gruppen B und C auf der Basis eines thermischen Dekontaminationsverfahrens vorgeschlagen. Dazu wurde beschlossen, ein komplexes Managementsystem der medizinischen Abfälle der Gruppen B und C am Beispiel des Stadtgebietes Rostow am Don unter Anwendung des Geoinformationssystems ArcGIS ESRI zu entwickeln und einzusetzen. Bei der Gestaltung eines Zentralsystems wurde in der ersten Phase eine Datenbank erzeugt, die Angaben über alle Objekte des städtischen Netzes von Gesundheitseinrichtungen enthält. Alle Objekte wurden im elektronischen Stadtplan eingetragen.

Auf Grund der Informationen über die Kapazität der therapeutisch-prophylaktischen Einrichtungen wurde quantitative und qualitative Zusammensetzung von anfallenden medizinischen Abfällen mit Hilfe der praktischen Anleitung zur Handhabung des TPE-Abfalls berechnet [Golubev D. A., Selesnev V. G., Mironenko O. V. – Sankt-Petersburg, 2001]. Die Berechnung ist zur Bestimmung der zur Bedarfsdeckung des betrachteten Netzes erforderlichen Leistung der thermischen Dekontaminationsanlage notwendig. Die erhaltenen Angaben über den Abfallumfang wurden zur früher erzeugten Datenbank in der Oberfläche ArcGIS ESRI hinzugefügt. Danach wurde eine virtuelle Karte erstellt,

die die Gesamtmenge der in den TPE von Rostow am Don anfallenden medizinischen Abfälle veranschaulicht.

Zur Errichtung der zentralen thermischen Dekontaminationsanlagen für Abfallgruppen B und C wurden 21 Basis-TPE mit höchstem Abfallumfang bestimmt, die in unmittelbarer Nähe zu kleineren Einrichtungen liegen. In jeder Basis-TPE wird die Errichtung von Anlagen mit verschiedenem Durchsatz vorgesehen, die für Behandlung der erforderlichen Abfallmenge der Abfallgruppen B und C von umliegenden Gesundheitseinrichtungen fähig sind.

Der Gesamtdurchsatz des vorgeschlagenen Netzes der Entsorgungsanlagen beträgt 820 000 kg pro Jahr und der Gesamtumfang der Abfallgruppen B und C des TPE-Netzes der Stadt Rostow am Don – 561 000 kg pro Jahr. Somit erlaubt die Leistung des vorgeschlagenen Netzes nicht nur den Bedarf der städtischen Gesundheitseinrichtungen zu decken, sondern auch die Verträge zur Entsorgung der schädlichen Abfälle mit den in anderer Trägerschaft stehenden Gesundheitseinrichtungen abzuschließen.

Somit wird durch die Anwendung der Ergebnisse der vorliegenden Studie der Übergang von Kommunen der Russischen Föderation auf ein neues Niveau der nachhaltigen Entwicklung sichergestellt, da diese auf Verbesserung der Lebensqualität der Bevölkerung sowie Umweltschutz gerichtet sind.

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COMPOSITION BASED ON FILLED POLYETHYLENE

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This work has been done to improve the processability and studying resistance to thermal oxidation of polyethylene in the presence of various inorganic fillers.

Properties of the composition is determined primarily by the nature of the filler, its dispersion, specific surface area of the particles, as well as the nature of the interaction between the polymer - filler. Polyethylene with mineral filler is mixed in powder form in a mixer for 5-6 hours at room temperature. Mixing quality was monitored by measuring the uniformity of the material by the filler content in the samples taken from various parts of the mixture, by optical microscopy and the physical-mechanical properties. Studied the viscosity characteristics and the mechanical properties of the filled polyethylene, crosslinked t-butyl peroxide in the presence of acrylonitrile and styrene. The fillers used talc, perlite, carbon black, aluminum powder, graphite.

The cross-linking of polyethylene filled with a vinyl monomer in the presence of an organic peroxides was carried out in the layout process. Introduction of the filler is not accompanied by an additional the layout process as degree of cure is somewhat smaller magnitude as compared to the unfilled composition.

Obviously, the bonding strength of the polymer chains with lower strength filler particles intermolecular bonds. We can therefore conclude that the structural mesh unfilled composition formed as a result of intermolecular interactions is stronger than the mesh that arises with the introduction of the filler.

Filled samples were subjected to a high temperature (300°C) except samples filled with aluminum powder, is less stable than the unfilled samples. The presence of cross-linked polyethylene 5-10 pph aluminum powder improves thermal oxidative stability by a factor 2-3 compared with the unfilled polyethylene apparently due to the formation of aluminum oxide film on the surface of the material slows down the rate of thermal degradation of the polymer.

It was of interest to reveal the influence of the nature and content of the filler on the viscosity properties (melt flow index) of the molten material.

Question of the plastic state of filled polymers is very important to select the optimum conditions for their processing.

When added to the polyethylene composition structured styrene, fillers such as perlite, carbon black, talc, fluidity is reduced slightly, and in case iron content flow index value increased approximately 2-fold compared with unfilled system. Vliyanie filler concentration hardly affects the yield of polyethylene.

Polyethylene-based structured styrene and acrylonitrile have been developed sealing gaskets. These seals are designed to install them on centrifugal pumps pumping the sulfuric acid.

To increase the life of the packing glands and thus improve the efficiency of centrifugal pumps, we have developed several versions of stuffing boxes based on a structured polyethylene. Manufacturing glands was measured by compression molding under the following process conditions: temperature - 170 °, the curing time - 30 min., Pressure - 10.0 MPa.

Each ring gland made separately, and then they were going to the package directly to the pump shaft. For this purpose, each ring an incision which allows the ring to flex due to the elasticity of the material and thus wear on the shaft.

Initially prototypes glands were made from polyethylene or structured styrene acrylonitrile in the presence of an organic perekisi. Ispytaniya conducted on pumps, showed that the efficiency of such glands short duration 3-4 days. The main reason was the deterioration of the material at points of contact with the rotating shaft, resulting in an air gap, through which flowed sulfuric acid.

In order to eliminate this drawback, it was necessary to reduce the coefficient of friction of the modified polyethylene. This was accomplished by introducing polyethylene structured graphite powder, which is known, is a good lubricant material.

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A REDUCTION IN THE EMISSION OF POLLUTANTS IN NATURAL GAS PROCESSING

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One of the environmental impacts of preparation of products from gas and gas-condensate wells for transportation is gas emission to the atmosphere. The emission sources of pollutants are safety and relief valves, vent stacks, flare stacks etc.

A research conducted by Gazprom OAO showed that the majority of emission of pollutants is represented by gas, the main component of which is methane. Methane emissions lead to the environmental degradation of the industrial location and a loss in the gas production. For this reason, a task of reducing the emission of pollutants is very critical.

This work studies a gas processing method in the area of one of the gas deposits in the north of Russia. Distinctive features of the deposits are: 1) the deposit is in the initial operation and the extracted gas has very high pressure, more than 11.5 MPa; 2) The method used for the gas processing is turboexpander technology. The gas is cooled to very low temperatures, lower than -30°C , as a result of which a live condensate is released from it. After the condensate is vented, a low pressure gas of approx. 0.8 MPa is formed. According to the existing processing method, a part of this LP gas is used for the plant's own needs, and the remaining part is used in the flare systems.

The objective of this work was to modernise the natural gas processing method in order to increase the efficiency of its use and to improve the environmental safety of the gas processing plant.

To achieve this objective, we carried out a process simulation of natural gas processing by means of a modelling environment Aspen HYSYS® (Aspen Technology, Inc.). As a result of this, we determined the composition and amount of the LP gas, which could vary within certain limits depending on the raw gas feed.

The essence of the suggested modernisation consists in the use of a system of ejectors to compress the LP gas and return it to the gas flow in preparation. In doing so, no additional energy costs are needed for the LP gas compression, because a part of the prepared gas serves as a processing medium.

The process simulation and calculations showed that this suggestion can be realised in principle. The ejector consists of the following construction elements: a nozzle of the HP working gas, an LP (ejected) gas chamber, a mixing chamber and a diffuser. The nozzle has to bring the gas to the entrance of the mixing chamber with minimal losses. The mixing chamber can have a cylindrical shape or have a cross-sectional area varying in length. The chamber shape has a significant influence on the mixing of gases. The length of the chamber must be selected in such a way that the mixing of flows is practically completed in it, but the chamber must be as short as possible not to increase hydraulic losses and to reduce the total dimensions of the ejector. The working gas parameters are as follows: pressure – 10.9 MPa;

flow rate – 0.039 kg/s; operating density – 115.2 kg/m³; temperature – 267°K. The parameters of the ejected gas are: pressure – 0.85 MPa; flow rate – 0.0067 kg/s; operating density – 8.17 kg/m³; temperature – 238°K. The parameters of the outgoing flow are: pressure – 4.64 MPa; flow rate – 0.046 kg/s; operating density – 51.22 kg/m³; temperature – 237°K. The ejector characteristics are: injected-flow rate – 0.18; compression ratio – 5.5.

The suggested technological solution will allow to increase the efficiency of the LP use and to reduce the negative environmental impact of the plant.

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MODELLIERUNG VON INFORMATIONSSYSTEMEN FÜR WIRKSAMES UMWELTMANAGEMENT

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Das Schaffen des Informationssystems, das den Zielen und den Aufgaben der wirksamen Steuerung der Umweltprojekte entsprechen würde, ist ein sehr komplizierter Prozess, der nicht nur Sammlung, Bearbeitung, Analyse, Übertragung und Nutzung von Informationen vermutet, sondern auch oft, um sie bei der Annahme der Entscheidungen vernunftgemäß zu verwenden, die Entwicklung einer bestimmten Reihenfolge der Leitungseinwirkungen für die Analyse und Korrektur des Systems selbst.

Im Zusammenhang damit, dass die Information eines der wichtigsten Führungsmittel ist, haben zukunftsorientierte Informationstechnologien in der Führungspraxis die Grundtendenzen ihrer Entwicklung vorherbestimmt. Diese sind verbunden mit der Entwicklung und Umsetzung:

1. der Technologien für die Einführung in den Datenverarbeitungsrechner der dokumentierter Informationen;
2. der Informationstechnologien, die alle gesammelten Informationen auf die Datenträger übertragen und den Nutzern die Arbeit mit den automatisierten Informationssystemen sparen;
3. der Integrations- und Informationstechnologien, die unterschiedliche Situationen modellieren können und den Zugang zur Information ermöglichen;
4. kognitiver Informationstechnologien, die kreative Fähigkeiten des Menschen entwickeln;
5. und intelligenter Informationssysteme, mit deren Hilfe Einzelteile des Kunstintellekts erarbeitet werden können.

Viele Wissenschaftler verbinden die Entwicklung von intelligenten Informationstechnologien mit der Entwicklung von Methoden, die es ermöglichen, die Aufgaben mit schwach formalisierbaren Bedingungen, Mehrzweckaufgaben und Aufgaben

mit nicht vollen oder nicht genauen Ausgangsangaben zu lösen. Das ist besonders für die Führungstätigkeit wichtig, indem man Entscheidungen unter Bedingungen von Unbestimmtheit und Risiko trifft.

Bei der Annahme der Leitungsentscheidungen verwendet man ziemlich oft die Prozess-Modellierung, die es ermöglicht, Entscheidungen nicht nur quantitativ einzuschätzen, sondern auch eine qualitative Analyse durchzuführen. Die moderne Theorie und Praxis des Prozessmanagements kombiniert heuristische und algorithmische Prozesse harmonisch, was wirksame und effiziente Modelle, die die Besonderheiten der Steuerung der Umweltprojekte widerspiegeln, zu schaffen lässt, indem man Erfahrung, Intuition, Kenntnisse des Leitungssubjekts und moderne Technologien für den Entscheidungsbeschluss vereint. Die wirksamste Entscheidung und wirksame Ergebnisse der Leitungseinwirkungen vermuten die Entwicklung einer Reihe von mathematischen Modellen. Das bedeutet jedoch nicht, dass die Formalisierung des Entscheidungsprozesses seine Effektivität eindeutig gewährleistet, schwach strukturierte Informationssysteme mit einem für sie typischen Anteil der Unbestimmtheit können mathematisch ziemlich oft schwierig modelliert werden. Wenn es jedoch gelingt, so lässt es innovative Technologien zu entwickeln und sie in den Leitungsprozess einzuführen. Zu den positiven Charakteristiken der Modellierung gehören auch: Anwendung der vielfältigsten Verfahren und Ansätze; hoher Grad an Motiviertheit bei den Entscheidungen; Kürzung des Zeitaufwands bei der Entscheidungsannahme; Einsparung der finanziellen und menschlichen Ressourcen; Durchführung der Bewertungsprognosen; Manipulation von Datenflüssen; Modelanalyse der komplizierten planmäßigen und Leitungssituationen; Alternativen bei der Problemlösung; Analyse und Einschätzung des Entscheidungsrisikos.

Gerade die Modellierung ist zurzeit tatsächlich eine einzige wirksame Methode, die Ergebnisse der alternativen Entscheidungen im Voraus bewerten mögliche Varianten der Zukunft voraussagen lässt.

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UMWELTRISIKEN DES ERDÖL- UND ERDGASZWEIGES

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Es ist kein Geheimnis, dass Russland eine Erdölmacht ist: zum Beispiel, im Jahre 2013 betrug der Anteil unseres Staates in der weltweiten Erdölförderung 12,2 % und wächst weiter (in diesem Zweig teilt Russland den Vorrang mit Saudi-Arabien). Das Niveau der Förderung von Erdöl- und Gaskondensat ist um 0,9 % im selben Jahr gestiegen und betrug 523,2 Mio. Tonnen.

Solches Förderungs- und Produktionsvolumen ergibt hohe Umweltrisiken:

- natürlicher Gas- und Ölschlupf bei der Ausbeutung (laut Statistik der Anteil des Ölverschmutzungsnotfalls erreicht 20-30% vom Gesamtausstoß der Schmutzstoffe);
- Treibhausgasemissionen beim Einsatz von Motorbrennstoff (obwohl der

Produktionsanteil von Brennstoffklasse 5 in den letzten Jahren durchschnittlich mehr als 50 % beträgt, ist die Schmutzstoffemission weniger als um 7 % gesunken);

- Transportmängel (Beschädigung von Rohrleitungen, Tankschiffe- und Bohrplattformpannen - laut Statistik werden zum Absatz- oder Bearbeitungsort nur 70-80 % Produktion geliefert).

Um jede Gruppe von Risiken vorauszusagen und die Folgenbeseitigung einzuschätzen, werden das statistische Verfahren (das Vorhandensein der Erfahrung bei der Projektrealisierung im entsprechenden Zweig) und das Verfahren der Experteneinschätzungen verwendet (wenn das Projekt zum ersten Mal durchgeführt wird).

Die von uns durchgeführten Forschungen haben gezeigt, dass das erste Verfahren für diesen Zweig annehmbar ist, denn er schließt das Begriffswerk der Wahrscheinlichkeitstheorie und der mathematischen Statistik ein. Das hilft die Wahrscheinlichkeit der Panne in der konkreten Gruppe und die notwendige Versicherungssumme für die Beseitigung der Umweltprobleme zu bestimmen.

Für die Einschätzung der Umweltrisiken des Erdöl- und Erdgaszweiges Russlands für 2015 müssen also die Angaben der letzten Jahre berücksichtigt werden:

- Die Zahl der Erdölabbüllungen (Ausfließen) beträgt durchschnittlich 4-5 % des Ausbeutungsvolumens jährlich;
- Der Umfang der Produktionsabfälle beträgt circa 200 T.;
- Der Umfang der vom Staat erzeugten/eingekauften Erdölprodukte in den letzten Jahren betrug durchschnittlich etwa 102,5 Mio. Tonnen (inkl. 61,8 Mio. Tonnen für den Binnenmarkt).

Die Aggregation und die Einschätzung der angegebenen Kennziffern hilft die Mängel des Risiko-Managements der Erdölgesellschaften im Jahre 2013 feststellen, und nicht nur die Wahrscheinlichkeit der Pannen dieser oder jener Kategorien voraussehen, sondern auch den möglichen Umweltschaden einschätzen, sowie die Kosten berechnen, die für die Folgenbeseitigung bei verschiedenen Pannen notwendig sind.

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UMWELTAKTIVITÄTEN DER RUSSISCHEN UNTERNEHMEN UND BESONDERHEIT IHRER INVESTITIONEN

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Die Steigerung der Attraktivität des Unternehmens ist in vieler Hinsicht von der Qualität der Planung und der Prognostizierung seiner weiteren Entwicklung, von der Fähigkeit, die zukunftsorientierten langfristigen Partnerbeziehungen zu knüpfen, von dem Verständnis, rechtzeitig neue Warenarten herzustellen, die die ökologische Sicherheit der

Umwelt gewährleisten, abhängig. Das fordert bedeutende Investitionen in die innovativen Entwicklungen solche wie ökologische Produktionsmittel, als auch moderne Kläranlagen. Auf solche Weise wird die innovative Investitionsattraktivität des Unternehmens in vieler Hinsicht von der Bereitschaft seiner Leitung zu den Neuerungen bestimmt.

Im Zusammenhang damit, dass russische Unternehmen für ihre großstäbliche Veränderungen in der Regel nicht genug Geldmittel haben, müssen sie interessierte Investoren suchen, was seinerseits bedeutet, dass die Kapitalanlagen mit hoher Rückerstattung versorgt werden müssen. Das kann man erreichen, wenn man auf den Markt hochleistungsfähige umweltfreundliche Innovationsprojekte bringt, die, falls sie abgesetzt werden, hohe Einkommen ergeben können, wenn man Informationstechnologien, Erfolgsmethoden für die Verwaltung der Firmen, neue Produktionstechnologien u.ä. verwendet.

Alle möglichen Aktivitäten des Unternehmens können als eine Gesamtheit der Geschäftsprozesse betrachtet werden, die sein wirksames Funktionieren sicherstellen. Gerade ihre Struktur und die Ganzheit der von ihnen erfüllten Funktionen gewährleisten deshalb dem Unternehmen seine weitere Entwicklungsrichtung. Seine ganze Wirtschaftstätigkeit sieht hohe Risiken voraus, die mit der Annahme der Entscheidungen unter den Bedingungen der Unbestimmtheit verbunden sind, deshalb, um innovative Öko-Projekte für die Umwandlung der Technologieprozesse, des Verwaltungssystems, der Unternehmensstruktur, der neuen Produktion einzuführen, muss man nicht nur den Plan der Rekonstruktion aufgrund der Berechnung der Effektivität der Investitionen nach den letzten Kennziffern entwickeln. Die innovative Investitionstätigkeit muss so geleitet werden, dass alle Bemühungen nicht auf den einzelnen Funktionen, sondern auf den Prozessen, die sich im ganzen Unternehmen stattfinden, konzentriert werden müssen, d.h. die Geschäftsprozesse, die die Handlungen aller Unternehmensabteilungen zu einem einheitlichen System vereinen, das Endergebnis ist das hohe Niveau der Koordination und der Qualität der ganzen Tätigkeit.

Die Entwicklung von Geschäftsprozessen, die der Innovations- und Investitionstätigkeit zugrunde liegen, ist mit bestimmten Aufwendungen und Risiken verbunden, darum ist es zweckmäßig, zuerst die für den Betrieb wichtigsten Prozesse anzusetzen, dann muss man sie erforschen und letztendlich vervollkommen. Dafür ist es notwendig, Kriterien auszuarbeiten, die ihre Wichtigkeit einschätzen können, und diese Prozesse nach ihrem Einfluss auf die Produktion und auf die Faktoren zu ordnen, die es erleichtern, die angesetzten Ziele mit wenigen Aufwendungen und für einen optimalen Zeitraum zu erreichen.

Da es mit den Geldmitteln im Betrieb knapp sein kann, und die Durchführung einer Maßnahme, die auf die Organisation effektiver Geschäftsprozesse gerichtet ist, das Vorhandensein bestimmter Finanzressourcen voraussetzt, so ist es bei dieser Arbeit zweckmäßig, Geschäftsprozesse zu bestimmen, die für den Betrieb von großer Bedeutung sind, und seine Aufmerksamkeit auf diese zu richten, indem man die anderen im Prozess der Umstrukturierung später einsetzt. Um vorrangige Geschäftsprozesse auszugrenzen, ist es notwendig, jene Kriterien zu bestimmen, nach denen sie eingeschätzt und systematisiert werden können.

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TREE PIGMENT COMPLEX COMPOSITION AS A DIAGNOSTIC INDICATOR OF URBAN ENVIRONMENT

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Photosynthetic activity of plants can serve as a criterion of their functional status in a city. It is very sensitive to environmental impact. Studying the dynamics of pigment content in tree leaves, depending on the degree of anthropogenic impact, is very important.

The goal of our study was to assess seasonal content of photosynthetic pigments in tree leaves in the urban environment.

The studies were carried out within the city of Saratov: near busy roads, around big industrial enterprises, and in recreational areas. The control plot was located 50 km north of Saratov. Leaves of *Betula pendula* and *Populus pyramidalis* were our research material. They were selected at a height of 1.5 m all the way around the trunk. Amounts of chlorophyll a, chlorophyll b and carotenoids in tree leaves were determined during the growing season. Concentrations of pigments were identified by using spectrophotometric method.

The high content of chlorophyll a was the trees in all functional areas of the city at the beginning of the growing season. In the beginning of growing season, the synthesis of chlorophyll a is fairly intensive. However, normal ratio of chlorophylls in the leaves is 2.5 - 3. The ratio of chlorophylls in our study was found to be considerably greater than it usually is. This finding supports the evidence of tree adaptation to adverse factors of urban environment by means of increasing the synthesis of chlorophyll a and, consequently, more intensive photosynthesis. The content of chlorophyll b in leaves was lower in all city areas compared with control values. It also implies tree adaptability to negative impact of the urban environment. Concentrations of carotenoids in *Betula pendula* and *Populus pyramidalis* leaves were 1.5 times lower than control values. This finding corresponds to the lower rate in leaves: 0.1 mg/g.

Chlorophyll b amount increase along with a decrease in the ratio of chlorophyll a/b was observed in all city areas at the end of the growing season. Accordingly, trees adapt to negative factors of the urban environment by increasing the concentration of chlorophyll b. It is known that the ratio of chlorophyll a/b decreases in polluted environments. This ratio characterizes the potential photochemical activity in leaves: the lower the ratio, the less the intensity of photosynthesis. Therefore, a decrease in photochemical activity was observed in city trees at the end of vegetative period under negative environmental impact. The content of carotenoids decreased only in leaves of *Betula pendula* at the end of the growing season. Increase of carotenoids was observed in *Populus pyramidalis* in recreational areas. Their concentrations are greatly reduced in the poplars growing near industrial enterprises. The amount of this pigment in poplar growing near busy city roads remained unchanged at a low level throughout the growing season. Consequently, carotenoid content in *Populus pyramidalis* is a more sensitive indicator than the *Betula pendula* carotenoid content.

Thus, pigment complexes in *Betula pendula* and *Populus pyramidalis* changed during the growing season. Amounts of pigments in tree leaves depended on the severity of anthropogenic impact. The highest degree of adaptation was observed in *Betula pendula* near busy city roads. It was higher than in poplars growing at sanitary protection zones of industrial enterprises. The content of carotenoids changed less under the influence of urban environment impact. This was due to their protective reaction in the oxidative degradation of pigments. Accordingly, the content of pigments in the leaves of *Betula pendula* and *Populus pyramidalis* could serve as a diagnostic indicator of urban environment conditions.

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ECOLOGICAL ARAL CRISIS AS THE CAUSE OF INFERTILITY IN WOMEN OF REPRODUCTIVE AGE

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At the present stage of social and economic development of society in the conditions of exacerbated adverse trends in health and demographic processes, it significantly increases the relevance of studying of problem of population reproductive health as one of the aspects of demographic policy. However, the solution of this problem is impossible without study of reproductive potential and the identification of influencing factors. The most informative characteristics of the environment are the indicators of female reproductive function as the most sensitive to the effects of adverse factors of different origin. The study of women's health issues, especially in the women of reproductive age, is not only a priority for research, but also the important task of the government, as the main indicators of health and demographic processes are birth and death rates. The important place among the causes of adverse effects in reproductive health has the environmental quality. The complicated ecological situation in Kyzylorda region is markedly affects the reproductive health of the female population. Emerging reproductive health disorders are manifested in the form of reduced fertility, i.e. inability to conceive a child.

Objective: to evaluate the reproductive function in women of reproductive age in Aral Sea region on the base on clinical and laboratory research, to identify the number of women with infertility.

The methods of the study: history taking, examination and palpation of breast, cervix inspection with mirrors, bimanual pelvic examination, determination of vaginal pH, smears for cytomorphology and oncocytopology, determination of level of prolactin and testosterone in blood plasma.

Results: in zone of ecological disaster (Aiteke-bi settlement and Aralsk city) in Kyzylorda region 686 women at the age of 18 – 49 years were examined. In the area of environmental crisis settlements Zhalagash, Zhusaly and Shiely respectively 199, 173 and 348 women of reproductive age were examined. In Aiteke-bi settlement 3% of women with primary

infertility and 2% of women with secondary infertility were revealed. In Aralsk 3% of women with primary and 5% with secondary infertility were revealed. In Zhalagash settlement the primary infertility was found in 3% of women and secondary infertility – in 4% of women. In Zhushaly settlement 2% of women were unable to give birth to their first child, and 6% of women, who already have children, were unable to give birth again. In Shiely settlement 3% of women with primary and 7% of women with secondary infertility were identified. From the above data it is clear that the structure of infertility has the prevalent number of women with secondary infertility. In this connection, there is a need to examine the causal relationship between exposure of toxic environmental factors on the reproductive function of the female population in these regions, which will allow identification the criteria for early diagnosis of diseases and a timely correction of these states.

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HARMONY IN ARCHITECTURE AS A SUSTAINABLE INTERACTION BETWEEN HUMAN LIVING AND THE ENVIRONMENT

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Harmony in the architecture has always played an honourable role in the development of human history and today it should become an important productive principle in the time of rapid changes, global cataclysms, strong destructive influences as well as a protective factor of human living.

Traditionally the term “harmony” in the architecture is divided into two compounds:

1) a physical (tangible) compound of harmony, that can be measured and described mathematically, to compare the compounds with the whole object, to present its graphic and colour image; 2) a spiritual and emotional (non-material) compound of harmony, that can be perceived on a sensual and subconscious level.

Harmony (in a certain private case) can be defined as a presence of some proportions (for example, «golden» proportion) in the object in question, as well as in architecture. The degree of manifestation of the “golden proportion” in an object of architecture is defined by a number of factors alongside the mastery of the architect (or artist). Numerous researches admit that the “golden” proportion is regarded as a general law, which is followed by the universe, the visible and invisible world.

Paradigm of harmonization in architecture might and must become a powerful factor of the contraction with destructive trends of development. Favourable impact of the harmony on an individual, which is evident through the many centuries of the development of mankind is displayed in most different aspects. For example, thanks internal accumulation of highest positive currents in the architectural environment created by a man.

Harmony in the architecture is found: a) in proportioning of construction objects; b) in landscape designing of architectural forms, which contain hidden landscape manifestations of the golden proportion. The hidden “geometry” can be defined as the manifestation of the concrete landscape (geometrical) proportions, which cannot be evidently “read” and their manifestation can be revealed indirectly, intuitively and subconsciously. Such highest landscape “order” of objects of architecture is responded in the human body with positive emotions, the perception of beauty, cleanness, comfort, music of soul and grace.

It can be affirmed that an opposite stipulation takes place: absence of harmony evokes negative turbulences in the soul, even when contrasts of forms, its dynamics and apparent originality attract with its “evil” attractiveness. Sometimes sloppiness, irregularity of forms can be deceivably viewed as beauty but such irregularity causes anxiety, negative feelings and destroys the psyche of the individual that lives in such environment.

A very important aspect in the work of an architect is his aspiration to implement the principle of the “golden” proportion, the principles of harmony with its heart and soul.

E.N. Sraubayev
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WORK AND HEALTH OF THE WORKING POPULATION OF KAZAKHSTAN

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Health indicators have always been a reflection of the socio - economic processes in the society. Socio-economic troubles of the last few years have a strong negative impact on the health status of the population. In the address of the President of Republic of Kazakhstan in the complex state measures indicated by the Government in 2020 there was a guideline on reducing total mortality by 30%. The basis of government social policy is to ensure the priority of preserving and improving the health of workers as the most important productive forces of society, defining the national security of the country and its economic development.

In the structure of total mortality occupy an important place mortality classified as preventable, including from diseases related to employment. Currently the preservation of labor and health of the working population of the Republic of Kazakhstan should be considered as a priority of government social policy. In August 2006, the WHO has developed the project “Global Action Plan for Health 2008-2017.” Which is considered by the World Health Assembly in May this year and is recommended for the development and establishment of national programs and systems of occupational medicine.

According to the Statistics Agency of Kazakhstan, in the country last year, 6.8 million worked man and the number of workers employed in hazardous work conditions on core activities, accounted for 20.8 percent. And on a number of mining companies, ferrous and nonferrous metallurgy, timber and woodworking industry figure is even higher.

Number of workplaces with harmful and dangerous working conditions in these sectors reaches almost half. This should add the fact that depreciation of fixed assets, including machinery and equipment, many enterprises 60-70 and even 90 percent.

Thus, overdue development of the National Programme “Work and health of the working population of Kazakhstan”, to develop a set of measures to reduce diseases related to employment that adversely affects the health of the population of Kazakhstan. Social benefits from the implementation of program activities will be expressed in: the drafting of national program “Work and health of the working population of Kazakhstan”, the development of evidence-based methods of professional risk management, reducing the risk of accidents at work and occupational diseases, reducing mortality among working-age population from preventable causes, providing favorable conditions for employees of organizations located in the territory of the Republic of Kazakhstan, the improvement of the demographic situation in the Republic of Kazakhstan.

The economic effect resulting from the implementation of program activities, can be expressed in reducing the cost of payments on compulsory social insurance against industrial accidents and occupational diseases, reduction of losses due to GDP loss of working time due to accidents at work and occupational diseases. Thus, the annual insurance premiums on compulsory social insurance against accidents at work and occupational diseases, as of January 1, 2014, amount to about 14 bln.tenge (Up to 4% of all social benefits).

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HEALTH OF THE POPULATION IN THE AFFECTED ZONE OF FUEL AND ENERGY COMPLEX OF KAZAKHSTAN

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Currently, the regions with intensive development of various industries experiencing significant multifactorial anthropogenic pressures, resulting in deterioration of the environment and the health of the resident population.

Objective: to analyze the health status of the population living near the fuel and energy complex of the Republic of Kazakhstan.

Materials and methods: The study population was Lebyazhye area (13 972 persons), located in the southeast of Pavlodar region. Control population Bayanaul area (27 787 people), located in the southwest of the Pavlodar region. Symptom differences in treatment and control groups - the geographical location of the area in relation to the source of pollution (GRES-1 Ekibastuz) based wind rose.

Subject of research - general and primary morbidity of the population. Identified nosological forms grouped according ICD - 10 per 100 000 population.

Results and discussion:

In Lebyazhye area high rates of respiratory diseases, the first place in its structure occupy bronchitis chronic and unspecified, emphysema.

Studying the dynamics of the primary respiratory diseases in children in the main group 2010- 2012 biennium, shows that among this cohort is observed in the whole unfavourable trend of growth of this disease (from 48,983.6 in 2009 to 55,800.8 in 2012 to 100 000). Marked increase in the incidence of asthma in children living in Lebyazhye area, in 2010, this nosology children not identified, and in 2011, her figure was 31.3, in 2012 g.- 94.6 per 100 thousand. People.

The share of preeclampsia complications as normal pregnancy, the main group above indicators in the field and in the control group. So, in 2012 he Lebyazhye area was 19.7%, in the Pavlodar region - 11.2% and in Bayanaul area - 5.9%.

Complications of pregnancy, childbirth and the postpartum period in the Pavlodar region in 2012, the structure of diseases occupy second place (7207.8 per 100 thousand. Of the population), giving primacy Respiratory Diseases.

Cardio-vascular morbidity in the same year, the study group - 2,2% and 0,2% kontrolnoy-. And the proportion of anemia in Lebyazhye area (2012 - 66.4%) higher than the region (62.0%) and Bayanaul area (45.4%). According to statistics, in the study area at a fraction of anemia in the structure of the complications of pregnancy, childbirth and the postpartum period, more than 50%.

The incidence of mental and behavioral disorders in Lebyazhye area is spread across all age groups, especially among children and the group tends to increase when the control group incidence rates stable.

Over the period 2009-2012, there is an increased incidence of tumors in the study area. The primary morbidity of the total population increased from 203.4 ‰_{0000} in 2009 to 316.9 ‰_{0000} in 2012. Whereas in the control group, the incidence of neoplasms of the total population declined from 485.6 ‰_{0000} in 2009 to 176.0 per 100 thousand. Population in 2012. The incidence of tumors in children in Bajanul area each year decreases, and vice versa in Lebyazhye area increases every year by almost 2 times.

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WORKING CONDITIONS AND HEALTH OF AGRICULTURAL WORKERS OF KARAGANDA REGION

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Provision of safe food, independence in the field of the international community is of great importance for the country's security, health and disability population in Kazakhstan. Hence special significance is the problem of maintaining the employment capacity and health of the inhabitants of the village. It should be recognized that the provision of safety and occupational health of workers of agriculture for various reasons

cannot be accomplished by methods similar to those used in solving relevant problems related to the urban population. Environmental degradation, lack of access to high quality health care, worsening socio-economic situation in the country, uncontrolled migration of the rural population (especially young people) in the city and other factors contributed to a sharp deterioration of the demographic processes, state of health of the rural population.

Purpose: Development of recommendations for improving working conditions and health status of agribusiness. Objectives: To evaluate the working conditions of workers of AIC. Analyze the incidence of workers of AIC.

Object of study: Agricultural (rural) workers Karaganda region (workers AIC). Subject of research: statistical data on morbidity; archival materials of DCCP (hygienic characteristics of working conditions studied groups).

The list of harmful factors affecting the employees of AIC: severity of manual labor, the labor intensity, dusty work environment, unfavorable microclimate (on the farm, in the cab, and so. D.), The noise, the vibration of the mechanism used, traumatic production process, pathogens, agrochemicals, pesticides, environmental factors (adverse weather conditions, and so on. d.) Specificity of harmful factors affecting the employees of AIC: frequent alternation of working operations performed in the dynamics of the work shift, one worker combining several professions, unsteady jobs with a large service area, the impact of frequently changing weather conditions, depending on the climatic zones, seasons, etc.

The main reasons for forming the adverse working conditions, inadequate processes - 45.3%, the structural weaknesses of workplaces and equipment - 28.7%, sanitation violations - 14.1%, a high proportion of manual labor - 5.4%, the violation safety - 4.6%, imperfection, lack of non-use of personal protective equipment - 1.9%.

Measures necessary for the improvement of working conditions: the modernization of technological processes, reconstruction and upgrading of equipment and machines and tractors, repair or installation of a lack of funds collective protection; decrease in the proportion of manual labor and optimization of work processes, the introduction of rational modes of work and rest, limiting the time of contact with harmful and dangerous factors for both work shift and professional experience - protection time propaganda safety and healthy lifestyles, improving the monitoring system observance of hygienic and sanitary requirements for working conditions, improving the system of continuous education and training in the field of labor protection of various categories of workers, the development of information systems professionals in the health and safety on the basis of the principles of management of professional risks, increasing the responsibility of the employer for violation of sanitary laws and his motivation to improve working conditions, improving the social and labor relations for the division of responsibilities of the employee and the employer on health damage in the workplace.

Thus, the working conditions of rural workers of the Karaganda region are

characterized by a complex of unfavorable factors. Adverse working conditions may be risk factors for the development of general and occupational diseases that lead to time, and in some cases, and persistent disability.

Milos Stankovic

APPARATUS FOR DESTROYING WEEDS

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Introduction

The problem of weed control, destroying parts of plants, outgrowth of similar plants in agricultural crops, urban parks and meadows are dating from the earliest days of agricultural production. For weed control, there are practical and widely used, and a numerous different methods. There is the most used mechanical and chemical treatment. Mechanically to mow or pull weeds, but it grows back, and this method is not long-term efficient because treatment should again be done, that adding to the cost. Chemical means are sprayed on weeds to destroying it, but that is not environmentally friendly. Using pesticides - polluting the land, food, drinking water and groundwater and others. Many diseases are obtained: sarcomas of soft tissues, cancer of the lung, cardiac arrhythmias, liver cancer, cancer of the urinary tract, leukemia, skin rash, asthmatic attacks, infertility in men and women, or children who are born with abnormalities, impede the hormones, effect on the hyperactivity and inability to maintain attention and others. According to the World Health Organization, about 25 million people per year globally are poisoned by pesticides, mostly in developing countries.

Technology

The apparatus consists of electronic components and electrode, use specific frequencies and electricity, destroying the weed at the root, ecological way, without pesticides, and it does not grow more during the season. When an electrical current passes through the weed plant, the plant occurs biophysical and biochemical reactions, followed by plant fade. With the apparatus should be done while the plants are small, as soon as possible, the purpose of lower power consumption. Every plant has its own resistance and for each type of plant is different. According to the density of the land, according to his strength and moisture, it needs to regulate the intensity of electric current by determining the number of electrodes and their spacing. This apparatus can be carried out and selectively control weeds, not destroying the useful plants and microorganisms. Apparatus is insulated so it is safe for humans and the surrounding area. It can be made of arbitrary power and set on a train, tractor, and handheld device for home use or city parks.

The handheld apparatus consists of an electronic box and the stick. A belt device can be fixed to the body, a stick on which the electrode is placed, that is held in the hand. The device is powered by battery and has very low power consumption. It is designed with a high degree of protection of safety, so that device is safe for humans to handle. Action of

particular current and frequency, by physical contact destroys weeds at the root and do not grow more during the season. Treating weeds its pollen remains sterile.

Efficiency of operation and economic savings

It is enough that only once treated weeds. With this device they will fade, you do not have to mow a few times or a few times sprayed with pesticides as it is done so far. Chemical weed is carried out 2-3 times per year during the season, while the cutting is done every 10-15 days, depending on climatic conditions. For the destruction of 1ha land covered with weeds for chemical agents spend 50 euro per treatment. Use of the apparatus only once at the beginning of the season, would destroy the weeds, the people would have a huge savings: human resources, equipment, machinery, machine maintenance, pesticides and etc.

The apparatus was tested in Belgrade, Slovenia, Germany and Sweden on Swedish University of Agriculture Science, Department of Crop Production Ecology. The apparatus is in the final stage of development.

V.E. Stepanov
V.E. Kolodeznikov

RADIONUCLIDES IN MOUSE-LIKE RODENTS AS INDICATORS OF A RADIOECOLOGICAL MONITORING BASIS OF URANIUM ORE DEPOSITS

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We measured radiocesium and depleted uranium (U-238) content in the fur, gastrointestinal tract (GIT) and body of mouse-like rodents in the area of the Elkonk uranium ore deposits. The measurements were taken before the construction of the ore mining and processing facility. We also examined the content of radionuclides in moss and lichen, parts of the food chain of mouse-like rodents. Small mammals do not migrate from their habitat and are, therefore, very convenient objects for controlling radioactive contamination in the proximity of a uranium ore extraction site. It was determined that the digestion coefficient was 9 for the fur, 25 for the GIT and 10 for the body. These coefficients are related to the concentration of radionuclides in the organs of rodents, thus increasing the sensitivity of the radiochemical spectrometric analysis. It was determined that the sensitivity of spectrometric measurements in combination with digestion was sufficient for the measurement of small radiocesium and uranium-232 concentrations in the organs of small mammals. Furthermore, we determined specific concentrations of radionuclides in the examined components of the environment and small animals.

V.E. Stepanov
N.E. Markova

THE RADIATION QUALITY OF COAL DEPOSITS OF YAKUTIA ON THE EXAMPLE OF HARBALAHSKIY DEPOSIT

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Coal costs on the first places on mining and the most available to use of the population and industry, not only worldwide, but also in the condition of Far North. Coal, which is burned in thermal power plants (TPP) and boiler rooms, contains a significant amount of radionuclides such as potassium-40, uranium-238, thorium-232 and their decay products, the activity of which is from 7 to 52 Bq / kg.

The study of natural radionuclides and their decay products in the territory of Harbalahski coal mine was carried in samples of coal, ash, lichen and snow cover. Based on the experimental results of the estimation of radioecological state and obtain the content of natural radionuclides:

In coal: Th-232 = 97 Bq / kg, Ra-226 = 2.7 Bq / kg, K-40 = 8.1 Bq / kg.

In the sol: Th-232 = 211 Bq / kg, Ra-226 = 0.38 Bq / kg, K-40 = 6.6 Bq / kg.

In snowpack: Ac-228 = 5.5 Bq / kg, U-235 = 0.43 Bq / kg, K-40 = 11.7 Bq / kg.

In lichen: K-40 = 18.5 Bq / kg, Ac-228 = 0.53 Bq / kg.

Identified specific effective activity of natural radionuclides in coal - 130.46 Bq / kg in ash - 277.351 Bq / kg. As a result, found that the specific effective activity of coal and ash refers to 1 building material class according to State Standard 30108-94 "Building materials and products. Determination of the specific effective activity of natural radionuclides. "Scope criterion for deciding on the use of building materials according to the hygienic standards region - all types of construction.

Disposal of ash and slag can be investigated as a filler for thermal insulation of the foundations of buildings, and for the manufacture of concrete as a building material.

V.E. Stepanov
G.A. Ignatieva
V.Y. Osipov

USE OF DISTRIBUTIONAL REGULARITIES OF ARTIFICIAL AND NATURALLY OCCURING RADIONUCLIDES FOR THE RADIOECOLOGICAL MONITORING BASIS IN YAKUTIA

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Yakutia is a federal subject of the Russian Federation, a part of the Far Eastern Federal District. We have studied soil, moss and lichen samples taken in different years. The measurements were carried out by means of a semiconductor gamma-ray spectrometer

with a detector made of high-purity germanium, manufactured by “Ortec” (US).

In the course of the field works, we carried out dosimeter measurements using radiation dosimeters of the type DBG-01H. 10 measurements were taken in every point at the height of 0.05m and 1m above the examined surface, then the mean value and standard deviation of the exposure dose rate were calculated.

We examined the surroundings of the town Tommot in the Aldansky District, situated in the south of Yakutia and in which there is a group of uranium ore deposits, as well as Oimyakonsk region situated in the south east of Yakutia.

Surface contamination by Cs-137 in the Elkonok uranium ore deposits region is 1425.2 Bq/m². This parameter equals 879 Bq/m² on the territory close to Yakutsk, which is a typical mean value for Yakutia.

The work [1, p. 60] shows that the Cs-137 content in the soil and vegetation cover in the lower course of the river Amga is 1370.7 Bq/m². Therefore, the surface contamination by radiocesium corresponds to the values typical for Yakutia in general and are caused by a global radioactive fallout.

The specific activity of naturally occurring radionuclides in the moss *Ptilidium Ciliare*, the samples of which were taken in the Bezymianny stream in the Aldansky district, was as follows: Th-232 (Tl-208) – between 17.3 and 49 Bq/kg; Ra-226 (Bi-214) between 25.26 and 911 Bq/kg; U-238 (Pa-234m) – 135208 Bq/kg; U-235 – 4848 Bq/kg.*

The content of naturally occurring radionuclides (Bq/kg) in the soil samples taken from the crossing of the road to mine 2 and the Bezymianny stream was as follows: Th-232(Tl-208) – 13 Bq/kg; U-238 (Pa-234m) – 196 Bq/kg; Ra-226 (Bi-214) – 16 Bq/kg; U-235 – 11.9 Bq/kg. Within the city limits of Yakutsk, the values were: Th-232 – 41 Bq/kg; U-238 (Pa-234m) – 42 Bq/kg; Ra-226 (Bi-214) – 22 Bq/kg; U-235 – 1.6 Bq/kg.

We also examined two lichen species, *cladina stellaris* and *stereocaulon paschale*. The content of radionuclides in the area close to the Zarechny settlement of the Aldansky district varied: on the southern slope of the mountain above the mine 3 constructions - Th-232(Tl-208) – 6 Bq/kg; Ra-226 (Bi-214) – 59.3 Bq/kg; U-235 – 3.4 Bq/kg; above the spoil dump 2 Ra-226 (Bi-214) – 38 Bq/kg; U-235 – 2.2 Bq/kg; in the tunnel No. 5 Th-232(Tl-208) – 7.9 Bq/kg; Ra-226 32 Bq/kg. The Ra-226 content in the proximity of the lake Diyucayaan and the Tyiya settlement of the Kobayansk district was 6.7 Bq/kg.

In the Kyubyume town area of the Oimyakonsk district, the surface contamination by Cs-137 varied from 173 to 238 Bq/m². We measured three lichen species and one moss species.

In the Kyubyume town area of the Oimyakonsk district, the content of radionuclides in the moss *Sphagnum* was as follows: Th-232 (Ac-228) – 73.3 Bq/kg; Ra-226 (Bi-214) – 503 Bq/kg; U-235 – 3.9 Bq/kg. The content of radiocesium varied between 39.1 Bq/kg and 1310 Bq/kg.

* - Th-232 and U-238 content in balance with daughter products.

V.E Stepanov
K.A Naumova

DEVELOPMENT OF FUEL COMPOSITIONS OF MSW

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For the experimental measurements, calorific fuel compositions of MSW (municipal solid waste) used antiradonic ceramic furnace with effect of low-temperature gasification. On the stove this stove put a bowl of water and a temperature sensor, and then at regular intervals records the temperature of the water in the vessel. Compose a graph of the time the water temperature in the heat sink. By plotting the temperature on the ordinate, and the abscissa the time, obtain the graph of the process. The area under the curve in this graph is called the thermal dose. The concept of thermal dose similar to the concept of exposure dose, since the area of the temperature chart is proportional to the amount of absorbed water, the amount of heat from the combustion of a certain mass of fuel (wood) in the combustion chamber of the furnace. The SI temperature dose is in units of degrees (Celsius) in the second ($\text{deg} \cdot \text{s}$). For convenience, we introduce the data Common Units dose temperature ($\text{deg} \cdot \text{min}$), and it is said to Stephen, abbreviated St. It is seen that 1 St is 60 degrees \cdot sec. Investigated three different fuel compositions: MSW1 and larch in a ratio of 2.5: 1, MSW1 and larch in the ratio 1: 3, MSW1 and larch 1: 6. As part MSW1 are plastic, wood waste, paper, MSW2 consists of coal chips, plastic, composed MSW3 plastic waste.

To determine the thermal dose form the balance equation for the process of heating water by the combustion of a fuel:

where S - thermal dose, k - coefficient of heat transfer oven, taking into account the loss

$$S = kHm\Delta t \quad (1)$$

of heat from the flue gases, H -calorific fuel ($\text{J} \setminus \text{kg}$), m - fuel weight (kg), Δt — the total time of combustion.

Using the heat balance equation (1) find:

the heating value of mixture MSW1 and larch:

$$H_{\text{MSW1} - \text{larch}} = 14,6 \cdot 10^6 \text{ J} \setminus \text{kg} = 3,7 \cdot 10^6 \text{ J} \setminus \text{kg}$$

the heating value of mixture MSW2 and larch:

$$H_{\text{MSW2} - \text{larch}} = 13,3 \cdot 10^6 \text{ J} \setminus \text{kg} = 3,325 \cdot 10^6 \text{ J} \setminus \text{kg}$$

the heating value of mixture MSW3 and larch:

$$H_{\text{MSW3} - \text{larch}} = 17,2 \cdot 10^6 \text{ J} \setminus \text{kg} = 4,3 \cdot 10^6 \text{ J} \setminus \text{kg}$$

As seen from the results obtained calorific mixture slightly larger calorific larch ($9.8 \text{ MJ} \setminus \text{kg}$). The reason is that the mass is less than the mass of waste wood from 3 to 15 times. Increasing the proportion of waste will lead to a corresponding increase in the calorific value of the fuel composition.

V.E. Stepanov
K.V. Stepanova

APPLICATION OF THE RADIATION INDUCED TEMPERATURE DOSIMETRY THEORY IN DYNAMICS OF STRUCTURAL TRANSFORMATIONS IN METALS AT WELDING PROCESSES

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Concepts of radiation physics connected with local characteristics of a joint weld are considered. The welding arc representing the electrons stream is “beta” radiation with generation of heat energy and the temperature increase. Metal melts for microseconds at local temperature increase.

Therefore, there is the temperature concept in each point of material or local temperature, the second integral characteristic of energy deposition on material in parallel with indicators of radiative effects on metals. This characteristic can replace radiation doses for the description of structural transformations state in metals and alloys.

Relations of power characteristics of welding process with a local temperature dose in the midpoint measured near a welding seam are researched. Effect of functional dependence of the local temperature increase from time determining material restructuring in the course of its heating by a welding arc is considered.

Experimental data of researches at Paton Electric Welding Institute of NAS of Ukraine on detection of differences between a thermal cycle of submerged arc welding (DC+) and a thermal cycle of pulsed arc flux welding are used.

For calculations the concept of an energy dose E (1) is entered:

$$E = \int_{t_0}^{t_1} U(t)I(t)dt \quad (1)$$

U – voltage,

I – welding current,

t – time.

And the temperature dose S (2) is equal:

$$S = \int_{t_0}^{t_1} T(t)dt \quad (2)$$

T – temperature.

The physical interpretation of energy dose concept: its value is equal to the total local energy emitted by electric current in midpoint of a weld.

The assumption is made that power and temperature doses are dependent in direct ratio and there is coefficient k :

$$E = kS \quad (3)$$

It is possible to calculate the emitted energy at process that equal to an energy dose if

you know the welding speed and length of weld. Geometrically, definite integral is the area of the figure limited to the some function graph. In this case four integrals are calculated using experimental data.

The coefficient k is calculated:

$$k = 0,0521304 \pm 0,0048669$$

Thus, it is shown that concepts and general trends have analogies in dynamics of welding processes. It is possible to describe the energy deposition of a welding arc on local structural changes in metal by means of local temperature dose concept. It is established that the temperature dose in a midpoint of a weld is proportional to a local temperature dose using experimental data.

V.E. Stepanov
K.A. Naumova

**RADIATION-INDUCED THERMAL DOSIMETRY
AND ITS APPLICATION TO THE CRYOGENIC PLANT
STIMULATION IN THE TREATMENT OF HUMAN
AND ANIMAL**

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Are known laws of physics, thermodynamics, namely, the laws of energy balance, momentum, simple and convenient in the local approach, when the differential equations are solved and the corresponding boundary value problems. But the actual physical processes occurring in systems with approximate dimensions over long time intervals and in this respect are nonlocal integral properties. The method of thermal dosimetry allows investigating experimentally as nonlocal and integral processes of energetic interaction thermodynamically nonequilibrium systems. Thermal dose - is an integral characteristic of the temperature influence on the object is equal to the area of the graph of temperature versus time. In the international system of units temperature dose has the dimension of a second degree. At negative temperatures characterize the negative impact of doses. To practice more convenient off-system unit called Stephen (St) - degree view of the minute. This method measured calorific values of municipal solid waste, rubber, plastics, waste automobile oil, coal crumbs, etc. in antiradonic gas generation ceramic furnaces. The high efficiency of these furnaces confirms the fact that they boil 10 liters of water for 5-10 minutes with a mixture of rubber waste and dry wood.

Using temperature dosimetry found optimal doses of liquid nitrogen cooling oats, wheat and lettuce. The optimal dose of cooling at which the increase in percent germination on average by 20%, it is shown that increasing the dose of cooling (from -0.28 to -0.841 MSt) results in a linear increase in the rate of growth of biomass.

Also studied the processes wound healing in laboratory rats. It is found that cooling liquid nitrogen vapors for three minutes in an experimental rat wound healed through one day, and the reference sample wound healed after 7 days.

Thus, the method of thermal dosimetry contains new nonlocal phenomenological principles to describe a wide range of processes of energy metabolism open nonequilibrium thermodynamic systems.

T.D. Strelnikova

THE LIPETSK REGION'S STABLE DEVELOPMENT AND ECOLOGICAL SECURITY

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The characteristics of the environmental situation of Russia's modern cities are presented in "The national policy's bases of Russia's ecological development through to 2030" in the section of "General Provisions": 54 % of urban population are suffered from high / ultra-high air pollution in 40 federal subjects of Russia. The volume of sewage water spewing out in surface-water bodies is still high. Almost all regions have the tendency of the land's environmental despoliation. The intensive exhaustion processes of farmland are observed. 27 federal subjects of Russia are desertified over a 100 mln. hectare area. The amount of wastes that are not involved in the secondary household turnover but directed to the distributing process is increasing. The waste storage and reinterment conditions do not meet the requirements of ecological security.

The Lipetsk region's stable development, high standards of living and also health standards may be achieved upon the relevant environment situation. The environmental issue should be included in the socio and economic system as the essential component of the national asset.

Russia's Agency of Hydrometeorology and Environmental Monitoring based on the air pollution index defined the Lipetsk region as one of the highly polluted in 2004. Hitherto the examined region was at very-high level.

One of the Lipetsk region's wealth is black earth that is under environmental risk now. Last year humus level decreased from 6,1 to 5,5 % in the Lipetsk region. The delay of timely measures directed to the soil fertility conservation will lead to the reduction of yields and as the consequence to the risk of food supply security.

Russian union of engineers estimated the climatic and ecological conditions of 164 cities where population number is more than 100 000 people. Lipetsk was defined as unfavorable for living as well as Norilsk, Cherepovets, Novokuznetsk and Magnitogorsk. It is rather difficult to be healthy in these cities with harsh weather conditions and bad environment. To such conclusion Russian union of engineers came.

Technology breakthrough is perceived as the means of these ecological problems

solving. Last years some developed countries oriented their strategy to ecological growth that is impossible without “green technologies”. These green technologies cover the following issues:

General ecological management (wastes managing, air and water pollution control, land restoration);

Renewable energy sources (solar energy). Biofuel is used in some farm firms in the Lipetsk region, the mitigation of climate changes and air pollution, the fuel efficiency increasing, building efficiency and energy efficiency technologies.

A.V. Sushkova
S.V. Mescheryakov

MODERN APPROACH TO THE PROCESSING OF OIL WASTES

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During storage of crude oil, fuel oil and heavy oil fractions with time in the tanks is an accumulation of deposits. Under the influence of the ambient temperature, the saturation moisture oil or heavy oil, as well as chemical and biological degradation, oil turns to reservoir cuttings.

Reservoir cuttings are stable multicomponent aggregative physicochemical systems consisting mainly of oil, water and mineral supplements (sand, clay, metallic oxides, etc.)

There is a partial oxidation of the feed oil with formation of a resin-like compounds and rusting tank wall. It occurs as a result of physicochemical interaction of oil-products with moisture, oxygen, air and mechanical impurities, and also with the material of the tank wall in the particular oil receiving tank.

In this case the moisture and mechanical pollution falling into the bulk oil, lead to the formation of water-in-oil emulsions and mineral dispersions.

The composition and physicochemical properties of the sludge, thus, may vary depending on environmental conditions and time of sludge formation. Important in this case is at what stage the storage of oil and oil products in the tank: directly in the oil field, on the pumping station, at a refinery or petrochemical plant.

There are several approaches to solving the problem of tank cleaning from oil. The first is the selection of oil and dissolved oil. At that problem is not completely solved, because bottoms, emulsion and muddy water are since still. Consequently, an additional mixing and separation of the resulting mixture are necessary. A second approach is that mixing occurs in the first stage. Further mixture is separated by tricanter. It is irrational from the point of view of reducing the degree of oil extraction.

With a long stay in the reservoir oil crystallizes out on walls of tank turning into asphaltic resinous paraffin (ARP) sediments. In this case it is necessary to choose the optimum technology for cleaning the walls of the tank from ARP sediments. At that the main condition is to maintain the internal insulation.

The main environmental problem of oil tank storage is the formation of lenses under the tanks. They are formed by a slight spillage during sampling, small cracks in the tank. These lenses may migrate, causing pollution of water withdrawal, surface water. Similar problems are encountered in the local areas of oil refinery plants, oil tank farms and military airfields. Accordingly, it is necessary to find out the extent of the lens and remove it.

The solution of a problem requires an individual approach, the selection of technology to solve the problem comprehensively, taking into account the component composition, physico-chemical properties, and the volume of generated wastes.

Thus the purification tanks must consider all aspects, starting with the separation of the oil component, ending with the selection of technology for vapor recovery of oil from reservoirs.

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DISPOSAL OF MEDICAL WASTE IN ASTANA

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In the "Strategic Plan for Sustainable Development of Astana until 2030" Cleaning and waste minimization is indicated as one of the major challenges facing the capital. A special place is occupied by medical waste generated in the course of treatment and prevention, health, wellness treatments in hospitals.

Taking into account that almost a third of all medical waste is infectious materials, creates difficulties in the disposal of them. That is why it is forbidden to carry out the destruction of medical waste in open areas, because various pathogens spread over hundreds of kilometers and can bring a harmful effect. It is also forbidden to carry out disposal of medical waste because of the possibility of contamination of soil and water. In this regard, infectious waste must be burned at very high temperatures. In addition, the high temperatures allow you to remove the dangerous emissions as dioxin. Unfortunately, currently used incinerators do not provide such temperature conditions.

The purpose of this paper is to identify methods and techniques for the disposal of medical waste in the Astana city.

We have studied the methods of disposal of medical waste RSE "Scientific - Research Institute of Traumatology and Orthopedics" (NIITO), JSC "National Research Center for Maternal and Child" (NRCMCH) and City Hospital No.1.

In JSC "NRCMCH" for 2013 formed the medical waste Of Class A - 3772 m³, which were collected and were stored in containers at the Centre, in the subsequent export to the landfill. Waste of Class B amounted to -15 268 kg (polymers), 4251 kg (dressing), 2790 kg (placenta), the waste class T (cytotoxic drugs, dishes with cytostatics and reagents) - 131 454 kg. Waste of Class B and D were collected in a room for

temporary storage in the refrigerator, and the container is then removed for disposal by private enterprises.

The volume of medical waste in the RSE “NIITO” for 2013 was : Class A - 2212 m³, Class B - 103467 kg, Class D: mercury-containing lamps -337 pcs., Medical thermometers - 212 pcs., Technical thermometers - 84 pcs. Class A's waste collected in a container, class B - in temporary locations, which were exported by private organizations. The Waste Of Class D was stored in metal containers, remote from the hospital at 200 meters, then exported municipal utility companies for recycling.

In a multi-city hospital number 1 it was setted a converter (Model N-25) that is designed for the processing and disposal of waste. This process equipment capable of converting waste into a sterile uniform absolute dry weight, which can be used as an alternative fuel in the cement industry, thermal power plants and hydroelectric power station.

Thus, in the removal of medical waste in Astana city there is no any single integrated system, which would include the entire set of actions for the collection, sorting, transport and treatment of waste.

The analysis of the methods of disposal the medical waste in health care settings of Astana city revealed that these methods need to be improved through the application of modern technologies to minimize environmental pollution.

A.A.Tichonova

PRACTICAL ASPECTS OF INDUSTRIAL RECLAMATION OF WASTE LAND

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Technogenic landscapes are evidently defective and even dangerous to a man's health. Besides, they form certain barriers on the ways of the planetary migration of substances and energy because of their low biological productivity and specific biophysical and biochemical properties. They distort the normal course of such fundamental processes in the biosphere, as the biological nitrogen cycle and the gas regime of the atmosphere reducing their intensity.

Characteristic of waste land is the destruction of the integrity and continuity of “the film of life” in the biosphere up to the complete extermination of soil and vegetation cover as a result of man's activities which by their significance could be compared to geological processes. Speaking of a negative impact of technogenic landscapes on the natural systems (and the health of the people, too) one should point out the so-called industrial dumps. They concentrate in close vicinity to the most towns and all major cities.

Reclamation is a complex of measures to be carried out in order to restore waste areas and land improving them to the state of safety.

Objects being reclaimed are open pit excavations, moulds caused by subsidence, cones, dumps of different kinds; land disturbed in the course of civil engineering work; grounds of solid wastes; lands disturbed as a result of contamination by liquid and gaseous wastes (ground contaminated by oil, gasogenic deserts, etc.).

To be distinguished are the following kinds of reclamation: technical, biological, and that of referring to civil engineering work.

Technical reclamation means the preliminary preparation of disturbed areas for different uses. The work includes the lay-out of a surface, removal, transportation and deposition of fertile soils on the land being reclaimed, the formation of the slopes of excavations, cultivation preparations, etc.

At the stage of technical reclamation the excavations are covered, deep pits turn into reservoirs, dumps and refuse grounds are wholly or partially dismantled, the underground waste is filled with “empty” blocks. The process of settlement completed, the surface of the land reclaimed is leveled.

Biological reclamation is carried out after the technical one to create a vegetation cover on the prepared areas. With its help the productivity of degraded lands is restored, the landscape green is formed, habitats for animals, plants, microorganisms, are created; fill-up soils are strengthened to protect them from water and wind erosion, hay and pasture lands evolve, etc. Biological reclamation is conducted on the basis of knowledge referring to the development of processes of succession.

There are certain requirements as regards the uses of lands. Depending on the goals they distinguish the following kinds of land reclamation: reclamation pertaining to the protection of the environment, reclamation in the sectors of recreation, agriculture, plant growing and water supply. To develop a reclamation project one should request a hydro-geological report (a prerequisite for the development of the project) for the areas to be reclaimed and perform sampling to determine the hazard class of dumped material as well as its approximate chemical composition. At the stage of development the project is coordinated with the Center of the State Sanitarian and Epidemic Control and is subject to the state ecological expertise. The project is to be developed by a licensed organization.

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CATALYTIC RECYCLING OF CHLORINATED HYDROCARBON WASTES TO SYNTHESIZE CARBON NANOCOMPOSITES BASED ON MICROFIBROUS MATERIALS

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Utilization of hazardous wastes is the first priority problem nowadays. For example, accumulation of organochlorine wastes during synthesis of vinyl chloride monomer is known to be very challenging issue as liquid chlorinated hydrocarbons cannot be buried or burned without catalysts because of possible formation of dioxins. As it was previously shown in our research, the catalytic chemical vapor deposition (CCVD) of 1,2-dichlorethane (principle

component of wastes) over nickel catalysts allows obtaining carbon nanofibers with high surface area.

In this work we applied aforementioned CCVD technique to modify surface of microfibrinous materials which are commonly used as reinforcement additives to polymer composites and concrete. Since it is well accepted that the surface of microfibrinous materials needs to be modified due to low adhesion level between fiber and composite matrix, we believed this method to be perspective.

Two ways of catalyst deposition were employed during research. In the first case, catalytic particles of nickel were deposited via impregnation technique with the following drying and reduction in hydrogen flow. In the second case, active nickel sites were supported over fiberglass by means of impregnation followed by surface self-propagating high-temperature synthesis (SHS). Preparation of experimental samples of carbon nanocomposites based on microfibrinous materials (CNF/MF composites) was carried out at vertical quartz apparatus via decomposition of 1,2-dichloroethane. In terms of research, samples x % CNF/MF were synthesized (x – wt. % CNF, ranged from 1 to 200%).

The CNF/MF composites obtained have been characterized using scanning and transmission electron microscopy. It was shown that the method suggested is useful for modifying different types of microfibrinous material (namely carbon fiber, glass fabrics and basalt fiber). It is worth mention that the developed method provides producing composites CNF/MF with feathery structure of carbon nanofiber.

Carbon nanofiber yield was found to be strongly depending on type of modified microfibrinous material as well as it depends on method of catalyst deposition. It was revealed that the yield of CNF product increases in the following order: fiberglass<basalt fiber<carbon fiber.

Using the BET method it was shown that surface area increased up to hundred times after modification. Since high surface area of reinforcement agent would increase adhesion level on “fiber/matrix” interface, it could be concluded that carbon nanocomposites based on microfibrinous materials might be promising additives to enhance certain physico-mechanical properties of polymers and concrete.

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G.A. Trakhtengerts

THE IMPACT OF TPS ASH DUMPS ON ENVIRONMENT AT ADJACENT TERRITORIES

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Many countries of the world, including Ukraine, use thermal power plants (TPP), which consume coal as a fuel, in order to produce electric power. Coal share in energy balance of Ukraine is equal to 36% (2012) and, considering existing problems, associated

with natural gas supply, shows trend to constant growth. Many powerful TPPs are operated within Ukraine. Such TPPs as Starobeshshevska, Luganska, Myronivska and Trypilska are the largest in the country and produce over 1000 MW. The technology provides for firing of dust-like coal and further removal of industrial waste, i.e. ash and slag, into ash dumps (AD) through hydrotransport.

Moreover, modern technology of fluoridated bed combustion of coal and injection of lime dust into burner is used in order to increase efficiency of power units.

This technology allows significant decrease sulfuric anhydride emission at power plants however prevents use of hydrotransport in ash disposal. Transportation of dry ash and slag requires additional measures for prevention of dust formation. The use of these technologies additionally increases ash output. For example, designed ash output of Slavyaskaya TPP is expected to be 45-50% of the weight of used fuel upon switching to coal fuel.

Utilization of wastes of coal power plants is one of the most critical issues. Today post-Soviet countries utilize not more than 10-15% of bottom ash materials. The rest is stored in ash dumps and not used. Accumulation of bottom ash has continuous nature. Amount of unused bottom ash is expected to increase, considering growth of demands for electric power and insufficient rates of development of other production sources.

Ash dumps are arranged in separate areas, located at large distances from main production areas of TPP, where power units are installed. Therefore they require installation of separate sanitary-protection zones (SPZ). However, conditions not always available for this.

It is well-known that negative geo-ecological processes and events take place even in case of normal operation of ash dump. These processes violate biological balance in the places of their location. There were cases of emergency situations at TPP ash dumps that had negative effect on ecological condition of adjacent territories. Soil, ground and natural waters are the most vulnerable in the impact area of ash dump under normal and emergency conditions since TPP ash and slag may contain larger concentrations of heavy metals and natural radioactive nuclides in comparison with used coal.

Adjacent territories can be polluted through acrogenic method, migration with atmospheric waters or filtration of contaminated waters through beds or flood walls.

Therefore it is necessary to improve approaches to installation of SPZ at such facilities. In most cases SPZs with size of 300 m may be insufficient due to widening of soil pollution area (which, in its turn, may become a source of the secondary pollution of atmospheric air and hydrosphere).

In order to determine actual impact area of ash dumps it is necessary to examine pollution level of atmospheric air, soil, ground and surface waters at adjacent territories.

V.A. Trefilov

CITY SAFETY MANAGEMENT*Perm National Research Polytechnic University, Perm, Russia*

The complex system of a modern city contains a large amount of various dangers for its population. The danger can be of an industrial, environmental, food, transport, social, information, economic or financial character or be caused by natural phenomena. A systematic analysis of dangers makes it possible to make a conclusion that it is very difficult to manage various systems. Each danger has its own sources and its own parameters: source power, distance and duration of a hazardous exposure. Each of the danger source parameters can be determined and quantitatively assessed in units typical for them. The same units are also used for the measurement of danger source parameters allowable for the city population. In doing so, it is obvious that each city can have its own allowable values for the sources of danger, although there certainly are universal allowable values typical for the population of any city.

The situation becomes dangerous in such a case if the source power, distance and duration of the hazardous exposure exceed their allowable values simultaneously. The probability of such a situation is the risk of the danger realisation in the corresponding direction.

Based on the above, it is possible to develop such a safety system that will reduce the parameters of the sources of danger to values lower than the allowable values and reduce the influence coefficients of the danger sources on each other to values close to zero.

To achieve these goals, it is necessary to have a unified, possibly automatic, safety management system.

City safety management consists of the following components:

1. Collection of information about all sources of danger.
2. Determination of influence each source of danger has on the others (using statistical data).
3. Uninterrupted risk assessment of dangers for the city.
4. Construction of a safety system for the city's population.

Conclusion. In order to gather the required information, it is necessary to determine the sources of danger, their parameters and allowable values and to organise their automated collection and count. The use of statistical methods of data processing will help to determine the influence coefficients, and, therefore, the possibility of the risk assessment for the population. The assessment makes it possible to objectively judge about necessary protective measures from potential dangers.

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TEST OF REMEDIATION TECHNIQUES FOR CONTAMINATED SOILS

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Storage of prohibited synthetic pesticides of older generation for subsequent disposal resulted in their accumulation in large quantities in soils in the areas of waste disposal. This applies to several types of pesticides, particularly organophosphate insecticides on the basis of methyl parathion, for example MetaphosTM.

One of the promising directions of cleaning soils from sustainable xenobiotics is the use of combined physical-biological methods based on the decomposition potential of soil microorganisms and high accumulating capacity of sorbents in relation to pollutants, in particular, methyl parathion.

The goal of our study was to create a biological product on the basis of strain-destructor – methyl parathion, obtained from the native microbial flora of chronically contaminated soils. The bacteria were immobilized in microcapsules. Consequently, we have tested remediation technologies for experimentally contaminated southern chernozem soils in laboratory and field conditions.

We experimentally established the conditions for extracting the consortium of bacteria, resistant to 100 maximum allowable concentrations (MAC) of methyl parathion.

We characterized strains-destructors MF1 – *B. subtilis*; MF2 – *P. putida* 8.3.2; MF5 – *Ochrobactrum thiophenivorans* 6.2.3; MF6 – *B. megaterium*; MF7 – *B. fastidiosus*; and MF8 – *B. laterosporus* - destructors of methyl parathion. These strains were able to use the pesticide in a concentration of 100 MAC as the sole source of carbon. For creation of biological preparation, we selected the strain of *B. subtilis* MF1 that was characterized by the ability to destroy 98.6% of methyl parathion in 7 days, and biomass during this time grew 38.6 times. The above listed strains were characterized by high adaptive and destructive capabilities towards soil contamination with 100 MAC of methyl parathion.

For the first time, we have justified the creation of a biological agent from the strain of methyl parathion destructor, *B. subtilis* MF1, immobilized on microcapsules of polyurea with diameter of 40-60 nm. We studied destructive capacity of biological preparation variants based on non-capsulated strain-destructors as well as on those immobilized on microcapsules in laboratory and field conditions while modeling the soil system, experimentally contaminated with 100 MAC of methyl parathion.

We identified optimal ways of using combinations of remediation techniques (irrigation, tillage, and introduction of biological destructors), providing maximal reduction in the concentration of methyl parathion pesticide and not causing detrimental changes in microbiological balances of southern chernozems.

We discovered that in the absence of technological agricultural practices and biological remediation, concentrations of methyl parathion in soils remained almost unchanged. Using technological agricultural practices without biological remediation stimulated the

activity of the indigenous microbial flora, which resulted in natural bioremediation of contaminated soils.

However, the degree of natural biodegradation of xenobiotics was insignificant. Using technological agricultural practices combined with introduction of strains-destructors to soils had a significant impact on the rates of bioremediation process.

The most effective option turned out to be using technological agricultural practices in combination with introduction of the biological preparation, based on strains-destructors, in microcapsules: methyl parathion was reduced by 96 % in 30 days. Encapsulation of methyl parathion strains-destructors was ten times more effective than conventional biological product.

The results of our study showed the possibility of application of encapsulated biological product under laboratory and field conditions for remediating negative impact caused by pesticide pollution.

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APARTMENT HOUSE NOISE EXPOSURE EVALUATION BECAUSE OF THE ROAD SECTION RECONSTRUCTION AND WAYS OF ITS DECREASE

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Reconstruction of roads may cause increase of noise levels above permitted standard values in the habitation located near to the reconstructed site. In the paper the forecast of noise levels in an apartment house in connection with reconstruction of a site of the Yaroslavl highway near to the Russian city Mytishi is executed. The reconstruction is made for the purpose of movement intensity increase and the traffic intersection organization as an overpass with maximum height of 13 m. Two apartment houses nine-stored and ten-stored are located near the reconstruction site. For transport noise reduction the noise barrier of the 7 meters high along Yaroslavl highway at the side of residential buildings and sound insulation glazing of the windows in living rooms of the apartment houses are provided in the reconstruction project.

The sound pressure levels at facades for each floor of the houses are calculated. As in the project it is not provided sound insulation glazing for windows in the kitchen rooms, the evaluation of the noise penetrating to the living quarters through kitchens was executed also. One- two- and three room apartments of a typical lay-out were considered in houses. The methods for road noise calculation and sound propagation indoors which remain in force in Russia are used. For noise level calculations the intersection and Yaroslavl highway were divided into sections according to explanatory note of the reconstruction project. It is distinguished nine line sound sources – road sections with different disposition and

traffic data. Calculation was carried out with use of the Russian program complex «ARM Acoustics». It is obtained the sound pressure levels of noise penetrating to living quarters from kitchen exceed the normative values stated in Russian sanitarian regulations for all flats of the nine-stored house. Thus for this house additional sound insulation glazing for kitchen glazing is necessary.

The calculated time-averaged A-weighted sound pressure levels exceed the normative values by 27 dB and 20 dB for the night and day time correspondingly at the facade of nine-stored house and by 22 dB and 13 dB at the facade of ten-storey house. So the sound insulation measures suggested in the reconstruction project are not sufficient. It is appropriate to evaluate the efficiency of additional noise barriers installation along some of the sections of the roads. For that purpose, was made the analysis of the sound sources contribution into the sound pressure levels at the points that are exposed to raised traffic noise most of all. For facade of the nine-stored house, which is located only by 20 m from the intersection and so is exposed by the raised noise mostly, lowering of the sound level after the installation of the noise barriers could be reached 18,4 dB. Noise barriers efficiency decreases with the height up to minimal values of 8,8 dB for day and 8,4 dB for night accordingly. Thus it is necessary further detailed development of sound insulation measures. It is required to screen all road sections with contributions to A-weighted sound pressure levels at the facades of the apartment houses more than permissible level of 55 dB for the night period. Appropriate selection of the height and length of the noise barriers should be made. Financially it might be more optimal an arrangement of the overall noise barrier above the intersection in form of a tunnel, especially taking into account essential decreasing of the noise barrier efficiency for the top floors of the buildings.

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NOISE REDUCTION FROM POWER STATIONS

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Noise is a serious ecological problem for the modern world. Noise is one of the essential factors of polluting the environment. In most countries, have laws to limit the negative impact of noise on the environment. In Russia, laws “On Air Protection” and “On Environmental Protection” obliged to implement measures for noise attenuation. The Russian sanitary standards SN 2.2.4/2.1.8.562-96 (for residential areas, working places to broadband frequencies from 31.5 up to 8000 Hz) and SN 2.2.4/2.1.8.583–96 (for residential areas, working places to broadband frequencies from 2 up to 16 Hz) establish permitted levels of noise in the workplace and housing areas. Operation of power-generating equipment associated with strong noise emission from it. Noise from power plants is a source of exceeding sanitary norms for the area the enterprises and the surrounding area. In comparison with other sources, the noise from thermal power plants

is a round-the-clock of the power equipment. The tonal components are present in the emission spectrum of power-generating equipment. High noise influence is the most serious ecological problem specific for power plants with gas turbines. Combined-cycle plants and gas-turbine units with heat-recovery boilers are widely used nowadays and often situated in large cities in immediate proximity to residential area.

The power station has a large number of intense sources of noise: steam jets, smoke exhausters, blower fans, transformers, cooling towers and other sources. Gas turbines are sources of intense noise also. Reduction of noise from large power plants is a complex task.

The strongest source of a temporary noise is discharge of steam. The permanent sources of noise are the air and gas paths of draft machines, the noise of the shells forced-draft equipment, coal-rolling equipment, transformers, cooling towers, boilers rooms, turbines rooms and other sources. The noises from the air and gas paths of gas turbines are strong sources of noise as well. The excess of the sanitary norms to the residential areas by continuously running power equipment can be up 1—30 dBA, and from temporary sources — 25—47 dBA.

All over the world are actively developing silencers to reduce noise power equipment.

In more than thirty years, MPEI carries out a set of works to reduce the noise power equipment. Here are the devices to reduce noise emissions of steam, draft machines, boilers, gas turbines, transformers and cooling towers

All steam emissions must be equipped with silencers in accordance with the regulations of Russia. To reduce the noise emissions of steam, developed a set of new steam silencers MPEI for a couple of different settings. The steam flow consumption through silencers ranged from 16 to 164 t/h. The acoustic efficiency of the measurement results made up to 38 dBA. MPEI steam silencers have high specific characteristics that allow reaching the maximum acoustic effect with minimum weight and maximum steam flow consumption through silencer. Silencers reduce noise emissions to the atmosphere of superheated and wet steam, natural gas, etc. The design of the silencers for wide range of parameters discharged steam and used as a block with up to critical parameters and on the block with supercritical parameters. In total, there are more than a hundred steam silencers.

Draft machines are the most abundant source of constant noise from power plants. The application of numerical methods for simulation of combustion gases on the 3D models allowed us to select the best option. The design of the silencer has reduced local resistance (the sudden expansion) and performance indicators with the most favorable aerodynamic shape.

Testing of all installed silencers showed a high acoustic performance and reliability. More than 350 MPEI silencers operated now.

Developed theoretical and practical solutions could solve the part of problems of reducing noise from the power stations.

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PERINATAL OUTCOMES IN WOMEN LIVING IN THE ARAL SEA ENVIRONMENTAL DISASTER REGION

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For the last fifty years the area of Aral sea water area was declined more than fourfold; the water volume has decreased ten times, its mineralization has increased as much time. As salt residues on the dried seabed contain lots of chemical fertilizers and toxic chemicals, inhalation of such air can negatively affect people and animal health of given regions. Impact of high concentration of the dust-salt aerosols, the raised background radiation on reproductive function influences perinatal outcomes in women living in the environmental disaster region.

Objective: To find out influence of the dust-salt aerosols, the raised background radiation on reproductive women health of fertile age. To study and assess perinatal outcomes in women living in the environmental crisis region for determining the approaches in practical recommendation development for the decrease of maternal and perinatal abnormalities in view of regional and environmental factors.

Research methods: history taking, your mammary glands inspection and palpation, cervical examination with a speculum, bimanual examination, vaginal flora pH determination, smear for cytomorphology and oncocytopology, prolactin and testosterone level determination.

Results: In the environmental disaster region in Aiteke – Bi Village and in Aralsk of Kysylorda region 686 women in the age of 18 - 50 years have been examined. Inclusion criterion for research was the factor of residing time of women of reproductive age in the ecological trouble area not less than 5 years, profession employment with hazards not above the second grade. By age criterion women have been distributed on three age groups: 18-29 years, 30-39 years, 40-49 years. In women living in the given area has been revealed the late menarche onset at the age of 16 years plus and makes 38 %. Later menarche is registered significantly more often than earlier and meets in 5,7 % of city women and in 10,5 % of rural women.

Perinatal losses in women in the environmental disaster region have been revealed in 24 %. Each fourth woman has in the anamnesis cases of spontaneous abortion and / or non-developing pregnancy which can happen many times again. Abortion incidence increases with the increase of years. It makes 15 % in group of 18-29 years and at the late reproductive age increases to 32 %. The cases of spontaneous abortion single shot in the anamnesis was observed in 44 %, two abortion in 11 %, three in 8 %, four in 1 %. According to a survey from the anamnesis following complications during pregnancy and deliveries were revealed: preterm birth in 21 women - 3 %; hemorrhage during pregnancy and deliveries have noted 8 - 1,2 %; arterial hypertension and eclampsia in 5 0,7 %.

The antenatal fetal death cases were observed in 17 women it made 2,5 %. By finding out of delivery parity and data of perinatal outcomes in women, children presence who

had congenital birth defects and hereditary genetic diseases were revealed: in Aiteke – Bi Village - 8,2 %; Aralsk - 9,9 %. Therefore we can assume that the impact of dust-salt aerosols high concentration and the raised background radiation leads to the increase of perinatal losses incidence in the examined women. To prove it and to develop the preventive measures directed to the decrease of perinatal losses, the further studying of population health impact of ecological factors is necessary.

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ALLOCATION OF HEAVY OIL FROM OIL-BITUMENE ROCKS OF KAZAKHSTAN

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The rapidly developing industry currently requires greater expenditure of energy and petrochemical raw materials [1], stocks of them will be exhausted in 2120 almost completely [2]. For intensive development of industry of the Republic of Kazakhstan requires rapid development of alternative sources of hydrocarbons. The major component of the raw material base of the oil industry in Kazakhstan are the reserves of heavy and bitumen oils.

For the development of alternative sources of hydrocarbon raw materials necessary to develop the optimal method of dividing it into organic and mineral components. In this work we used techniques aqueous alkaline extraction [3, 4], the organic solvent extraction method and thermal distillation. Thermal distillation of oilbitumene rocks (OBR) carried out on pyrolysis installation at a temperature of 430-450 °C without access of air. This method allows to split the OBR to the liquid, gaseous and solid parts. The industrial separation of oil-bitumen rocks were devised [5].

Western Kazakhstan's oilbitumene rocks of Tub-Karagan and Munaily-Mola fields (f) from different wells were used for investigation.

Results of extraction showed that the content of the organic part in OBR of various fields varies from 10,75 to 16,50%. The content of the organic part of the OBR from f. Tub-Karagan was 12.50-14.20% and OBR from f. Munaily-Mola - (15.10-16.50%). The mineral part - 87.50-85.80% and 8.90-83.50%, respectively. Similar results were obtained for the extraction with an organic solvent. Content of bitumene fraction (CBF) in oilbitumene rocks were defined by thermal distillation. OBR were separated to a liquid (l) and gas (g) products. In oilbitumene rocks of f. Tub- Karagan SBF is equal 14% (13.82% (l) and 0.18% (g) and in samples of the OBR f. Munaily-Mola CBF for the samples from three wells are equal: 18.6%, 11.5% and 14.4%, respectively. The amount of liquid products of thermal distillation: 8.2%, 2.32% and 5.52%, and gases compounds: 10.4%,

9.18% and 8.92%, respectively. The size of particles of the dispersed phase of the mineral components varies between $(1.0-1.7) \cdot 10^{-5} \text{ m}$.

It was established that used methods have the same degree of extraction (98-100%).

For practical purposes preferred method is the water-alkali extraction due to the cheapness of the reagents and environmental safety.

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INVESTIGATION OF NATURAL BITUMEN AND COMPOSITIONS BASED OIL-BITUMENE ROCKS OF WESTERN KAZAKHSTAN BY ELECTRON PARAMAGNETIC RESONANCE

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At present particularly acute problems of both theoretical and practical interest is the study of oil-bitumene rocks (OBR), which can be widely used in various sectors of the construction industry as a roofing and waterproofing mastic, anti-corrosion and road surfaces. In connection with the reduction of hydrocarbon (HC) and the need to improve the ecological environment of interest to consider the issues of complex extraction and use of oil-contaminated soil, sludge, sediment, and the OBR. The reserves of OBR in Western Kazakhstan is estimated at 950-1000 million tons.

Oil-bitumene rocks of Western Kazakhstan Tyubkaragan field by electron paramagnetic resonance were studied. It was shown that the shape and width of the electron-spin resonance signal depends of the nature oil-bitumene rocks, conditions of the activation of them and introduction of various additives. A significant increasing the signal amplitude of free radicals is observed during the extraction of bitumen from oil-bitumene rocks by aqueous alkaline solution under heating. Dry distillation of oil-bitumene rocks amplifies signals to 4-5 times.

In this work oil-bitumene rocks of field Tyubkaragan of Western Kazakhstan, the well 606, the interval of 58-105 m (sample number 1), the well 46/91 (sample number 2) with different promoters and additives were studied, using the EPR method.

Electron-spin resonance spectroscopic studies were carried out at the Institute of Nuclear Physics of the National Nuclear Center of the Republic of Kazakhstan. Recording the spectra were carried out at selected conditions of reception in two bands of magnetic fields in order to obtain more detailed information as possible about the presence of ferromagnetic impurities, complexes, comprising paramagnetic ions, and about the concentration and, possibly, the structure and localization of free radical components. Samples were placed in standard ampoules of firm "Bruker" and weighed. The resulting

spectra were processed using proprietary software «WINEPR», thus normalized for rigging and led to the standard conditions of registration.

The results were obtained in the form of stacks of spectra, allowing to compare samples of the same origin, depending on the additives or processing method. EPR spectra of samples OBR with modifying additives were obtained at room temperature, heating and dry distillation, were recorded on a spectrometer ESR 300E of firm “Bruker” under identical conditions.

Samples OBR were crushed, mixed with various additives at room temperature. Extraction of bitumen extraction with an aqueous alkaline solution in the presence of sodium silicate was performed at 90 °C for 40 minutes. For the modification were used polymeric binders and various additives. They were then poured into molds and were solidified at room temperature for 48 hours.

Signal of amplitudes of free radicals sharply increases (4-5 times), are changing the shape and signals's width, the values of q-factors. This is caused by hydrocarbons and the appearance of the two liquid phases, inherent maltenes and asphaltenes. Content of bitumen in the sample number 46/91 after the dry distillation was 6.6%.

I.I. Ustinova

URBO-PHYSICAL GROUNDS OF WAVE URBAN STUDIES

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Issues of sustainable development are critical for modern Ukraine, depopulation of which occurred within 1993-2006 due to rapid reduction of urban population against the background of further extension of cities' territory. This phenomenon evidences that urbanization process in Ukraine, like in developed countries, moves from growth to stagnation phase and it is necessary to carry out special studies in order to explain it. Study and mathematical description of development trends of urbanized territories as environmental and urban systems (EUS) shows some similarities in the frequency of change of its main parameters and other physical values that have wave nature: pendulum motion and capacitor discharge through induced coil.

It emerged that mechanical, electromagnetic and urban-ecological processes follow similar quantitative rules. This fact can be disclosed if you are interested not in the object but in nature of the fluctuations. Disclosed analogies predestine interest to future search of physical regularities in urbanization process.

It was disclosed that all laws in nature has a common base, i.e. energy conservation law (Largrange, 1788; Maxwell 1855). This law states that any change in generated (free) energy is compensated by change in lost (coupled) energy. This law is known as “changeability of unchangeable” in philosophy, invariant in mathematics, tensor in physics and ecosystem self-regulation law in environmental biology. In accordance with this law ecosystem

provides for definite capacity for every biological species. The reserve of this capacity (lack of population at the territory) determines growth and its exhaust (overpopulation of the territory) results in reduction of number of species. In accordance with results of our study this phenomenon was disclosed in development trend of EUS. All four types of fundamental interactions are observed in this dynamics: strong, weak, gravitational and electromagnetic. These and other results of study (published in Euro-Eco 2010 – 2013) allow us to formulate main thesis of “urbo-physics” of ecological environment, content of which has appeared to comply with postulates of new physics of unified field (Bishkek version).

New physics, based on model of Rotating Universe, states that uniform power field forms the basis of all physical interactions. The idea of absolute plays a special role in this physics. This idea puts uniform, universal and simple to the forefront. Due to this these laws become common for all levels and systems. New physics is based on thesis, stating that all coordinate systems are absolute. These coordinates are determined by ecosystem self-regulation law in development of urbanized theories. The city is the center, around which “urbanization environment” rotates. Absolute physics uses fundamentally new mechanics, i.e. mechanics of body movement “from the inside”. In our case such mechanics is a development of EUS population-environment in ecological environment city-region, suability of which is ensured by change in its quantitative states and territorial borders in multi-level cycles of wave development. Models of development of biological and social systems are created on the basis of uniform field physics.

This gives birth to wave power and ethnic prognostics, which are new fields of science and have active cross-disciplinary integration. Theories of Ron Hubbard (Dianetics), Hentry Altshuller (theory of Innovative Problem Solving) and Lev Gumelev (Passionarity Theory) were developed in this way. All above-mentioned facts give rise to new field in town-planning science, i.e. wave urban studies, as a science, dealing with management of wave processes of development of the territories in order to ensure planning conditions of stable development of society.

B. Utegulov
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STUDY OF COMBINED ELECTRICAL DISCHARGE FOR DISINFECTION AND CLEANING OF NATURAL AND WASTE WATER

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According to a method developed for the disinfection and cleaning of natural and waste water, experimental studies on combined electrical discharge have been carried out using a device for disinfecting and cleaning water. The method of disinfection and cleaning of natural and waste water is based on simultaneously using stable glow and arc

electrical discharge between two groups of electrodes, which are powered by their own independent power supply.

The method is implemented using a device for cleaning and disinfection of natural and waste water. The device includes a chamber for water treatment, which is made of a dielectric material. At the bottom of the chamber a lower electrode is attached, which is made from a metal plate. In the upper part of the chamber two groups of fasteners with two fixing bases made of dielectric material for placing the dielectric tubes are installed. The dielectric tube has a thin hole on one side, and comprises a fastening device for controlling the movements of the metal electrode on the other side. The metal electrode is placed on the inside of the dielectric tube. Dielectric tubes with electrodes are located vertically, with one end of the electrode being pointed. The chamber for water treatment in the upper part comprises a branch pipe through which water enters the chamber, and the bottom part of the chamber has another branch pipe through which the water is drained after treatment by a diaphragm electrical discharge. For the alternating voltage, two independent power sources are used.

The method of disinfection and cleaning of natural and waste water is as follows: on the lower electrode and movable electrode of the first group, alternating voltage is supplied from the source of the first group. Between the electrodes, a diaphragm electrical glow discharge appears. On the lower electrode and movable electrode of the second group, alternating voltage is supplied from the source of the second group; thus a diaphragm arc electrical discharge appears between the electrodes of the second group. In addition, groups of fasteners regulate the distance between the electrodes to improve the efficiency of the diaphragm electrical discharges.

It should be noted that the known methods and devices for cleaning and disinfection of natural and waste water, based on diaphragm electrical discharge, do not allow simultaneously obtaining glow and arc electrical discharges between the electrodes. That does not allow efficiently obtaining ozone, radicals H, OH, singlet oxygen, various peroxides and nitrous hydrogen, ultraviolet excited molecules and erosion of the electrode material in an electric discharge concurrently.

The method developed for cleaning and disinfection of natural and waste water provides for the implementation of cleaning and disinfection with two groups of electrodes: one of them with its own power source provides a stable glow discharge between the electrodes, and the second group with its own power source provides a stable arc electrical discharge between the electrodes.

Studies have shown the efficacy of combined electrical discharge in a device for cleaning and disinfection of water. Since the range of voltage from 840 to 900 V formed a glow electric discharge on the electrodes, and voltage changes from 1200 to 1400 V formed an arc electric discharge on the electrodes, the total water treatment time is an average of 15 minutes for volume of 1 m³.

With effective diaphragm electric glow and arc discharges, the rate of cleaning and disinfection of natural and waste water increases. The productivity of the device is doubled

through the use of the combined electric discharge in disinfecting and cleaning water. The proposed method for cleaning and disinfecting natural and waste water improves the efficiency of water treatment. The length of time necessary to clean and disinfect 1 m³ of water has been determined through experimentation.

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V.E. Stepanov

**STUDY OF WIND AND LOW TEMPERATURES
ON THE LUMINOSITY OF DIFFERENT TYPES OF LAMPS
THROUGH THE METHOD OF THERMAL DOSIMETRY**

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Winter wind conditions were simulated by blowing lamps behind the cab of car moving at different speeds. Incandescent lamp with capacity of 75W, fluorescent lamp KEL-FS E27 20W, SuperMax SPC E2742 T3 35W, Classic LED E27 6W (4200K warm white light) were studied at temperature of minus 42C. Brightness was estimated using homemade light meter consisting of solar battery with an area of 36 square centimeters and connected to a voltmeter. Increasing brightness of the source led to increasing voltage. The experiment was carried out on the road in the dark. At the beginning of the experiment the data of voltmeter were registered at room temperature indoors to calibrate the process of changing the light output.

It was determined that the light intensity issued glow of incandescent bulbs was increased by 1 percent at minus 42C in comparison with the room temperature. The light intensity remained unchanged under influence of wind with speed of up to 30 km/h. From 35 km/h to 100 km/h intensity was hopping, decreased by 1 percent and increased by 2 percent from primary indications at room temperature.

The light flux from the glow of fluorescent lamps at minus 42C decreased by 9 percent as compared with the room temperature. The lamp brightness did not change under influence of wind with speed of up to 50 km/h. Light intensity began to diminish from speed of 55 km/h. At speed of 100 km/h it decreased by 12 percent from the initial indications at room temperature.

LED lamp increased brightness by 2.5 percent at minus 42C as compared with the room temperature. The light intensity gradually increased when wind reached speed of 40 km/h. At wind speed of 100 km/h the brightness increased by 5.5 percent from the primary indications at room temperature.

Thus, the experiment showed that from these three kinds of lamps only lamp Classic LED E27 6W (4200K warm white light) has good light output. Consequently, it is more to use LED lamps in street lighting in the winter. Unlike conventional light sources,

lighting by LEDs has several advantages: low energy consumption, long duration of work, small size, high reliability, the ability to rapidly switch and safe use.

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APPLICATION OF COMBINED FILTERING COMPOSITIONS BASED ON NANOSTRUCTURED MATERIALS USED FOR SURFACE WATER PURIFICATION

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Provisioning of the Russian Federation population with high quality drinking water is one of the most urgent problems of the moment. Water pollution affects its physical properties and chemical composition, reduces dissolved oxygen content, while the possibility of pathogenic bacteria penetration might cause infection outbreaks and epidemic occurrences.

Therefore, an establishment of effective water filtration systems capable to absorb large amounts of chemical pollutants and pathogenic bacteria is a relevant and important task.

The goal of this study was creation of multilayer filtering systems based on nanostructured sorbents and comparison of their filtration efficiencies at the Kirsanov Water Treatment Plant.

The filter basis were bentonite granules obtained by nanostructured bentonite clay annealed under various conditions using the technology developed at the Scientific Production Enterprise "Lisskon" (Saratov, Russia). We used poly oxazolidine ammonia ion hydrate as the innovative bactericidal component of the nanostructured biopolymer. This polymer has anti-microbial properties due to formation of electrostatic bonds between the polymer and bacterial membrane, and also due to the hydrate ions incorporation into the polymer structure. The polymer is non-toxic to animals and humans.

We developed two filtering compositions, 100 ml each, containing the same components, but differing in terms of the filtering composition structure.

The first filtering composition had four layers: three were adsorptive and one in the middle was bactericidal, the second filtering composition had the same constituents, but the layer numbers were greater, and each layer had smaller volume and was repeated more often.

The preliminary mechanical cleaning of wastewaters at Kirsanov Water Treatment Plant was followed by filtering through experimental filtering compositions at a velocity of 2 mL per minute.

Water samples were analyzed for basic chemical, physical, and microbiological parameters before and after filtering. Also, we conducted the comparative analysis of our data with the official sanitary requirements in the Russian Federation (2.1.7.573-96 and 2.1.4.1074-01).

It was established that the second filtering composition was able to reduce amounts of pollutants in wastewaters up to the levels drinking quality water. The efficiency of this composition was superior to the ability of the first filtering composition from 2 up to 50%.

The mineralization rate decreased by 30% after filtering through the second composition (from 1180 mg/l to 817 mg/l), CFU and odour reduced on 100%. The chroma and turbidity decreased by about 92% (from 140° to 5° for chroma and from 14,6 mg/l to 1,2 mg/l from turbidity). Parameter of iron and phosphates reduced on 50-80%. The hardness, alkalinity and pH in control were consistent with standards and decreased slightly after filtering. Parameter of nitrites, nitrates and COD reduced on 12-15%.

Thus, the use of combined filters provides a solution to two problems: waste water treatment and decontamination. Their use can significantly reduce chroma and turbidity, adsorb heavy metal ions, nitrites and nitrates.

In this connection, it is possible to create different commercial product versions: from municipal water to the jug filters small rural settlements. Combined filtering systems can be used in water purification plants in enterprises of middle and small business, housing, Garden cooperatives, private consumption, as well as other water users.

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ABOUT THE PECULIARITIES OF THERMAL PROTECTION IN HARSH ENVIRONMENTS

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It is known that Russia has the largest territory in the world and has the wide range of climatic zones. The main part of the population lives in the European part of the territory, however, significant energy resources are located in the Eastern and Northern regions.

Integral index of severity of climatic conditions is an indicator of degree-days of heating period in the region, the city. It is calculated in accordance with Russian Set of Rules (Building Codes - SNiP) 131.13330.2012 (23.01.1999), and is for Moscow 4700, Yekaterinburg 5800, and, for example, Hannover (Germany) - 2600. The comparison of these indicators means that the climate in these cities is more than 2 times harsher (respectively).

In connection with the above example it is clear that the thermal protection of buildings and structures in Russia should be increased characteristics in comparison with European countries. In the Ural Federal University the project "Energy Efficient house" has been developed and implemented, the main feature of which is using polistirolbeton with high-quality insulating properties and renewable energy sources.

The first phase of the project consisted in providing high thermal insulation characteristics of the object. At this stage in different years (2002-2006) termogravimetria was carried out to eliminate heat loss. In the second stage of the project was to tackle the

issue of energy supply from renewable energy sources: wind power plants (wind turbines), solar panels (solar cells), solar collectors (SC), heat pump (HP), micro hydro power plant (mHPP), wind-driven lift pump and biogas unit (BGU).

Currently, the project has been implemented in various systems of renewable energy are regularly checked for efficiency.

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SAMPLING – A KEY STAGE IN THE STUDY OF ENVIRONMENTAL OBJECTS

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The report examines the role of sampling in quantitative chemical analysis of environmental objects: natural water, soil and air. In it, in particular, are the definitions of "test" and "sampling"; describes the types of samples (point, composite, etc.), the main purpose of sampling (study of the composition and properties of H_2O to identify sources of pollution) and its methods: one-time, periodic, continuous and serial. Sufficient detail highlights the issues related to the choice of location points for the analysis of water from rivers, streams, lakes, reservoirs and ponds (natural or artificial); containers for sampling of natural water: glasses graduated, plastic cylinder or cylinders made of stainless steel and automatic samplers; recommended methods of transportation, storage and preservation of samples to define the generic, chemical and organoleptic parameters.

Certain parts of the report are devoted to a description of the choice of location points for the study of soil (elementary areas and methods of sample plots), the types of samples (point combined) and the peculiarities of their selection (envelope method). Depth it usually depends on the concentration of pollutants and the goals of the study (to determine the degree of contamination of the surface layer, the migration of chemical substances on the profile, etc.) and is 0-20 cm, 20-40 cm and 40-60 cm. Enough detail with the related to the choice of sampling equipment: soil knives, scoops, spatulas, bayonet shovels, hand drills soil of various designs, as well as the main methods of primary processing of selected soil samples (drying, crushing and removal of large inclusions, sieving, dividing by a mechanical divider or by hand by quartering and grinding) and necessary for carrying out these operations equipment.

The final section is devoted to sampling the atmosphere. It defines the concept of aspiration, discusses types of aspiration method of sampling (in the absorption devices on solid sorbents for chemosorbents and filters) and their main disadvantages as well as used by adsorbing devices and materials. In particular, the report discusses in some detail of solid sorbents and chemosorbents, the classification of the aerosol filters. Possibilities of sampling the limited capacity of vessels (containers) of different volume from 1.0 to 2.0 liters recommended for studying air with a high content of various volatile at ordinary

temperature hydrocarbons by gas chromatography and gas chromatography-mass spectrometry; particular choice of location of measuring points and the conditions under which a sample reflects the most likely nature of the medium under investigation.

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RETURNING OF LANDS, CONTAMINATED AS A RESULT OF RADIATION ACCIDENTS, TO FARMING USE

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In spite of improved safety measures on nuclear fuel cycle enterprises, infrequent radiation accidents may lead to radioactive contamination of spacious areas, water bodies and farming lands. According to assessment of Japan Atomic Energy Agency (JAEA) and the Nuclear Safety Commission of Japan, approximately $1.1 \cdot 10^{16}$ Bq of ^{137}Cs and ^{134}Cs were emitted into atmosphere after Fukushima accident in 2011. Density of pollution by ^{134}Cs and ^{137}Cs radionuclides in the most contaminated regions of Japan is from 10 to $1 \cdot 10^4$ kBq m^{-2} . Specific activity of soils varied from 0.1 to 380 kBq kg^{-1} , while those of vegetation were 68 to 968 kBq kg^{-1} . High density of population in Japan and lack of free territories make necessary remediation of radioactively contaminated lands for decreasing of radiation hazard and returning of population to abiding places as well as for returning of low contaminated soils to farming use.

Addition of sorption-active substances may be an effective method of remediation of soils with the aim of their returning to farming use, if used sorbents will possess affinity to natural systems, high selectivity to radionuclides and irreversibility of sorption for strong retention of radionuclides and prevention of their migration and transfer through food chains. A number of publications suggest using natural aluminosilicates and sorbents based on them for remediation of contaminated lands, however, these publications do not contain comparative analysis of using of various materials, questions of selectivity and reversibility of sorption are also not discussed.

The comparative study of selectivity and reversibility of radiocaesium and radiostrontium sorption by natural aluminosilicates (glaucanite and clinoptilolite) as well as by modified ferrocyanide sorbents, based on these aluminosilicates, is made. The assessment of possibility of these sorbents using for remediation of radioactively contaminated lands, as a result of radiation accidents (including Fukushima accident), with the aim of their returning to farming use is also made. It is shown that surface modification of aluminosilicates by ferrocyanides allows to increase selectivity of synthesized sorbents to caesium in 100-1000 times, to increase sorption capacity, to make caesium sorption almost irreversible, meanwhile, selectivity of these sorbents to strontium radionuclides remains approximately the same as for natural aluminosilicates. Caesium distribution coefficient for mixed nickel-potassium ferrocyanide on glaucanite is $10^{(5.0 \pm 0.6)}$ mL g^{-1} , static

exchange capacity (SEC) is 63 mg g^{-1} ; for mixed nickel-potassium ferrocyanide based on clinoptilolite caesium distribution coefficients in various concentration ranges are $10^{(7.0 \pm 1.0)}$, $10^{(5.7 \pm 0.4)}$ and $10^{(3.2 \pm 0.7)}$ mL g^{-1} , total SEC is 500 mg g^{-1} .

Reversibility of sorption of caesium by natural aluminosilicates and ferrocyanide sorbents based on aluminosilicates was determined as caesium leaching degrees and leaching rates from samples, saturated by radionuclides. Caesium leaching by various leachants from saturated mixed nickel-potassium ferrocyanide based on clinoptilolite was lower than 2%, from saturated mixed nickel-potassium ferrocyanide based on glauconite was $-1.5 - 14.6\%$.

Ferrocyanide sorbents, based on glauconite and clinoptilolite, are recommended for remediation of lands, contaminated by caesium as a result of Fukushima accident in Japan. Using of these sorbents will allow decreasing transfer of caesium to agricultural vegetation in up to 20 times. Pilot batch of modified glauconite is now testing in Japan at lands, contaminated after Fukushima accident.

V.A. Zakamski

SOIL AND FOREST CONDITION MONITORING IN THE OIL REFINERY

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Soil preservation and control over the condition of forest near an oil refinery are determined by the integrity of nature and rational nature management. In the industry, it is important to know what can be changed and what should not be done. It is important to know to which degree one can influence soil, water resources, flora and fauna and when it is necessary to stop in order to preserve the environment.

For these reasons, researchers have an important task to minimise the negative effect to ecosystems by developing monitoring techniques, in particular, for the most important industrial production, especially of the oil-refining character.

Based on the above, the main objectives for ecologists working in an oil refinery must be directed towards the preservation and restoration of natural complexes and characteristic vegetation. An unfavourable effect should be ascribed to anthropogenic, zoogenic, phytogenic, parasitogenic and digressional and demutational fluctuations connected with the extinction of the main components in the phytocenosis as well as the loss of the aesthetic attractiveness and soil conservation function by the living ground cover. Natural landscapes on territories directly adjoining an oil refinery are not supposed to have irreversible changes or irregularities in structure and composition typical for indigenous forests.

For this reason, the objective of the soil and forest ecosystems monitoring in the sanitary protection zone of the oil refinery can be formulated as follows: to control the

state of the vegetation and ground cover and to detect and prevent unfavourable changes in the object under observation in time.

In order to solve the problems mentioned above, we have been successfully applying an international project in the field of the forest monitoring called the International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP-Forest) carried out within the framework of the Convention on Long-Range Transboundary Air Pollution under the protection of the United Nations Economic Commission for Europe.

The expected results are:

- Techniques and organisation methods of the constant monitoring with the prior assessment of the ecological state of forest vegetation on the territory directly adjoining an oil refinery;
- Methodology of creating a regular bioindication network and data collection with tested convenient fixation forms of assessment results and control over the stability of natural complexes;
- Main specifications of quantitative and qualitative characteristics of the condition of forest vegetation in relation to natural and anthropogenic factors.

According to the research results, the plant management and monitoring organisations are recommended to take a series of measures in order to predict the environmental condition and carry out an environmental stability control of forest phytocenoses in the sanitary protection zone of the oil refinery for the purpose of prevention and elimination of its pollution.

Possible users of the results are:

- oil refineries and other chemical plants which change the environment,
- ministries and departments which control nature management, ecology, land use and forestry.

M.V. Zaretskaya

NEW MONITORING METHODS OF GEOECOLOGICAL SAFETY

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A major threat for the national economic complex and population safety in Krasnodar Krai and the North Caucasus is created by exogenous and endogenous natural geological processes. Due to the fact that the environmental safety of Krasnodar Krai and the neighbouring republics of the North Caucasus is directly related to the seismic safety, the development of a complex geoecological monitoring system must also include monitoring and assessment of seismic activity.

The monitoring system of seismic conditions on the territory of Krasnodar Krai consists of the following elements:

1. Measuring equipment for obtaining, processing and assessing information about the seismic situation in the region;
2. Measuring equipment for obtaining information about the main factors, which influence seismic intensity;
3. Equipment for assessing the Earth's deep structure;
4. Complex of mathematical models for assessing the stress-strain state of the lithosphere plate on the territory.

An earthquake means a destruction of the lithosphere plate, which is accompanied by a release of elastic stresses energy accumulated in the lithosphere plate due to external effects. There are several possible scenarios of a lithosphere plate destruction.

In cases of a homogenous structure of the plate, the points of rupture are situated in the zones with the highest concentration of stresses.

In case of seismic faults, the destruction takes place at the top of cracks, inclusions or other complex structures of an inhomogeneous type.

There are also other possibilities for lithosphere plates to be destructed. They take place when several factors have a simultaneous influence and happen under a certain set of circumstances.

The presence of mathematical models and equipment in the monitoring system of the seismic activity allowed for the development of the assessment method of a seismic hazard in the region by using a rating method of seismic roads described below.

A source of vibration and a seismic station are installed in the centre of the examined territory. On the periphery of the examined territory, a group of seismic stations is placed in such a way so that seismic roads – direct lines between each seismic station and the source of vibration – would go through the most significant and vitally important objects on the territory. The data collection point from all the seismic stations, both the base one and the periphery ones, contains a computer with software that enables to calculate changes in the stress-strain state of the Earth's crust along the seismic roads. In doing so, the considered parameters are the time delay between the base seismic station and the peripheral ones in regard to the incoming earthquake wave; difference in the amplitudes of oscillation between the base and peripheral seismic stations; difference in the amplitudes between the previous and current measurements and the already known structure of the Earth's crust along the seismic roads. For a given moment of time along each seismic road, we make a deduction about the degree of the rock safety factor in the Earth's crust.

By means of a transmitting equipment, the computer can be connected to a receiving unit of organisations which carry out geoeological safety monitoring of the territory in order to transfer the obtained information and to determine the degree of the seismic hazard. The complex allows for a permanent monitoring of the seismic situation. In case of a real danger, the population can be informed in a timely manner.

P.M. Zhuk

DIE BEWERTUNG DER ÖKOLOGISCHEN EFFIZIENZ BEI DER VERWENDUNG VON DÄMMSTOFFEN

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Wie ist es schon bekannt, optimiertes Dämmen kann ein Schritt zu vernünftige Entscheidungen im Bauwesen sein. Von einer Seite sind Wärmedämmstoffe umweltentlastend, weil die Heizaufwände und damit verbundene Belastungen durch die Anwendung von diesen Materialien reduziert werden können. Aber von anderer Seite müssen die Umweltaufwendungen durch Herstellung, Einbau, Instandhaltung und Entsorgung (Recycling) der Dämmstoffe in Betracht gezogen werden. Energieeffizienz vom Dämmstoff rechnet auf: 1. Umweltentlastung durch Wärmedämmen, weil die Heizung bedeutende Quelle der Umwelteinwirkungen darstellt; 2. Umweltbelastung, die mit Umwelteinwirkungen bei allen Lebenszyklusphasen verbunden ist.

So ist eine Aufgabe sehr wichtig, diese positiven und negativen Effekte vergleichen zu dürfen. Es wird vorgeschlagen, für die Bewertung der Effizienz von Dämmstoffen einen Koeffizienten zu verwenden, der das Verhältnis der eingesparten Energie zu der angewendeten, nicht erneubaren Energie zeigt. Die Gegenüberstellung des Aufwandes an Primärenergie bei der Herstellung bzw. im vollständigen Lebenszyklus und der Einsparung an Primärenergie unter ausgewählten Randbedingungen und Annahmen ist damit möglich. Das Verhältnis ist sehr ähnlich mit s.g. EROI Koeffizient (Energy Return on Investment). Die Berechnung von EROI wurde von Prof. Ch. A.S. Hall für die Beurteilung der Effizienz von Fossilien erfolgreich genutzt. Es gibt schon viele Methoden für die Berechnung von energetischer Amortisation (bzw. von Dauer, bis Energie zur Herstellung durch Einsparung kompensiert ist). Bei der Berechnung der Einsparung muss die Art der gedämmten Konstruktion unbedingt berücksichtigt werden. Zum Beispiel beim Dämmen vom Dach werden die Wärmeverluste auf 3-7% reduziert. Und beim Dämmen der Außenwände auf 9-13%. Außerdem die Dauer der Berechnung kommt auf die Art des Bauelementes an. Die Berechnungen für die Klimabedingungen in Russland zeigten, dass 1 m³ der Mineralwolle ermöglicht die Einsparung 41-47 GJ pro Jahr. Primärenergieverbrauch nach dem Lebenszyklus von Dämmstoffen kann man aus Environmental Products Declarations (EPDs) entnehmen. Wenn wir Energieeffizienz Index (I_{ec}) als Verhältnis der Energieeinsparung zu Energieaufwand für die Herstellung vom Dämmstoff bestimmen, dann bekommen wir, dass I_{ec} von 65 bis 75 pro Jahr beträgt. Gemäß der Prinzipdarstellung der energetischen Amortisation nach Prof. Th. Lützkendorf Mineralwolle hat energetische Amortisationsdauer 2,72 Monate (im Vergleich mit EPS 4,46). Außerdem bei der Einschätzung der Dämmstoffe müssen nicht nur energetische, sondern auch bauphysikalische, human- und ökotoxikologische Aspekte berücksichtigt werden. Diese Einwirkungen können wirtschaftlicher Weise ausgedrückt werden. Zum Beispiel mit der Berücksichtigung von diesen Effekten wurde 2-fach mehrere Effizienz der

Entwicklung von neuen Bindemitteln für Mineralwolle im Vergleich mit Verbesserung von Formaldehydharzen nachgewiesen. Index der Energieeffizienz kann Planern, Architekten und Ingenieuren Antworten auf Ihre Fragen betreffend die Dämmstoffauswahl liefern. In Anbetracht des Klimas in Russland kann man feststellen, dass ein Grossteil des derzeitigen Gebäudebestandes unzureichend Wärme gedämmt ist. Die Wärmedämmung von Neuß und Altbauten auf hohem Niveau ist aus Gründen Ressourcen- und Umweltschutzes dringend notwendig. Als Folge muss der Anstieg des Verbrauchs von Dämmstoffen berücksichtigt werden. Dafür müssen in erster Linie energiesparende, möglichst langlebige und schadstoffarme Dämmsysteme eingesetzt werden. Nach der Nutzung von diesen Systemen sollen die Dämmstoffe erneut verwendbar sein.

SEMINAR

**“EUROPEAN EXPERIENCE IN MANAGEMENT
OF MUNICIPAL FINANCES”**

27.— 28. NOVEMBER 2014

ANDOR HOTEL PLAZA

HANNOVER, GERMANY

Dmitry Arzamastev
Larisa Shulgina

RETROSPEKTIVE FORSCHUNG DES ÖKONOMISCHEN DENKENS

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Der Klassiker politischer Ökonomist Adam Smith (Schottland 1723-1790) hat die klassische Arbeitstheorie des Wertes geschaffen. Hat das Buch "die Forschung über die Natur und die Gründe des Reichtums der Völker" geschrieben. Sie hat den Prozess des Entstehens der klassischen politischen Ökonomie wie die Wissenschaften beendet. A.Smith hat den Gegenstand des Studiums der politischen Ökonomie – die öffentliche wirtschaftliche Entwicklung und die Größe des Wohlstands bestimmt. Smith betrachtete die ökonomischen Gesetze und nannte sie als "die unsichtbare Hand", meinte, dass eine Haupttriebkraft des Marktes die Konkurrenz ist. Des Menschen betrachtete er wie des Wirtschaftsegoisten, dessen Ziel die Vergrößerung des eigenen Reichtums ist. Für den Reichtum der Nation hielt Smith die Größe der materiellen Produktion. Der Wert der Waren klärt sich von den Aufwänden des Werkes.

David Rikardo (England 1772-1823). Er betrachtete in "Die Anfänge der politischen Ökonomie und der Steuerbesteuerung" die Probleme der Verteilung des Produktes zwischen den Klassen. Hat die Handlung des Wertgesetzes rechtfertigt. Verwendete die Methode der Abstraktion bei den Forschungen. Untersuchte die geldliche Behandlung. Betrachtete die Probleme des Ersatzes des goldenen Geldes auf papier.

Jean Batist Sej (Frankreich 1767-1832) unabhängig von ihm hat das Wertgesetz abgefasst, hat die Theorie «drei Faktoren» geschaffen, entsprechend denen jeder Teilnehmer der Produktion das Einkommen proportional zu drei davon angelegten Produktionsfaktoren bekommt: der Erde, dem Werk oder dem Kapital.

Der Sozialismus-Utopismus. Klod Henry Sen-Simon (1760-1825), Charles Fourier (1772-1837) und Robert Ouen (1771-1858). Sie war der Versuch nicht nur in der Theorie, sondern auch in der Praxis gemacht, die sozialistischen Ideen der Produktion und der Verteilung zu realisieren. So hat R.Ouen in Schottland das Unternehmen geschaffen, wo die Ideen des rechtmäßigen Werkes, der Verteilung und des Austausches der Lebensmittel durchführte. Mit 1800 bis 1829 arbeitete das Unternehmen und blühte, ungeachtet der Krisen in der Wirtschaft des Landes. Jedoch hat es mit dem Abgang R.Ouenas den Bankrott erlitten.

Der Marxismus. Karl Marx (Deutschland 1818-1883). Der deutsche Philosoph und der Ökonom hat die Arbeitstheorie des Wertes beendet und hat die politische Ökonomie des Kapitalismus geschaffen. Dazu hat er die Ergebnisse der Forschungen nicht nur A.Smita und D.Rikardos, sondern auch der Sozialisten-utopizm, sowie der deutschen Philosophen-Klassiker zusammengefasst.

K.Marx betrachtete Ware wie die Zelle des kapitalistischen Marktes und aufgrund seiner Analyse hat die Widersprüchlichkeit der Marktwirtschaft gezeigt. Marx hat in die

Wirtschaft die Klassenbeziehungen eingeführt und hat das Gesetz des Mehrwerts und das Gesetz des mittleren Gewinns, wie das Ergebnis des Betriebes von den Unternehmern der Arbeiterklasse, wobei, nicht nur auf einem Unternehmen oder in einem Land, sondern auch im internationalen Maßstab abgefasst (von hier aus – seine politische Lösung “die Proletarier aller Länder, verbinden Sie sich!”). Er hat den Begriff der Norm des Betriebes, des Kapitals, der Zyklizität der wirtschaftlichen Entwicklung des Kapitalismus eingeführt. Von der Grundlage des Austausches der Waren vermutete er die Zahl des Werkes, das in ihnen gelegt ist. Das Werk des Arbeiters betrachtete er wie abstrakt und konkret, einfach und kompliziert, bezahlt und unbezahlt. Marx hat die berühmte Formel des Wertes der Ware aufgestellt:

$$W = c + v + m,$$

Wo W – der Wert der Ware, um dem Wert des ständigen Kapitals, des Aufwandes des Unternehmers; v – der Wert des variablen Kapitals, des Aufwandes der Arbeitskraft, m – der Mehrwert, der vom unbezahlten Werk des Arbeiters geschaffen ist, sich formend auf dem Markt des Gewinns.

Die Theorie der Höchnützlichkeit. In des Zugrunde Lernens die Theorie der Höchnützlichkeit liegt die Nutzung der Höchstgrößen für die Analyse der Wirtschaft. Es wird die Theorie der Höchnützlichkeit verwendet, das heißt, jede Ware hat den Wert adäquat dem Nutzen, den die letzte Einheit dieser Ware, die das am wenigsten wichtige Bedürfnis befriedigt bringt. In diese Analyse werden die mathematischen Methoden breit verwendet. Es wird hauptsächlich die Mikrowirtschaft, das heißt, die Wirtschaft auf der Höhe der abgesonderten Firmen, sowie – das Verhalten des Konsumenten analysiert. Die Erscheinungen werden in der Statik, das heißt, im Gleichgewichtszustand untersucht. Ein Hauptproblem der Forschung ist die rationale Nutzung der begrenzten Ressourcen. Forschungn haben die Wissenschaft Economics geschaffen, wobei für die Hauptaufgabe des Forschers sie das Studium nicht angewandt, und “der reinen” Wirtschaft hielten. Im Unterschied zu den Klassikern Forschung die Aufmerksamkeit konzentrierten nicht auf die Fragen der Produktion, und auf den Fragen der Nachfrage und der Vorschlag.

A.M. Grinkevich
Z.E. Sakharova
L.S. Grinkevich

DISTINCTIVE FEATURES OF FISCAL FEDERALISM IN THE RUSSIAN FEDERATION AND ITS IMPACT ON THE OPERATION EFFICIENCY OF MUNICIPAL ENTITIES

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The current fiscal federalism in Russia was developed under the conditions of drastic reformatations in the political and financial system. At the same time, its introduction was accelerated, thus leading to considerable social and economic costs. It does not correspond to the typical approaches towards organisation and operation of fiscal

mechanisms in federal countries established in the developed Western countries.

We would like to point out the main distinctive features of the fiscal federalism in the Russian Federation:

- high level of centralisation of funds when declaring the principles of federalism;
- inadequacy of income of regional and municipal budgets to their vested powers, including the declared social security protection and obligations;
- extremely low level of the sources of income assigned to administrative and, particularly, municipal entities;
- limited possibilities in the area of tax base management at the level of administrative and municipal entities as well as additional fiscal and legal limitations in the taking of independent decisions in spite of a considerable amount of transfer payments;
- in general, considerable amounts of transfer payments in different forms, the budgeting procedure of which is not transparent or reproducible, thus encouraging dependency and disinterest in the development of the proper tax potential;
- considerable distortions in the financial income between large cities and municipal entities of other types;
- volume of tax authorities allocated to sub-federal levels of power is unsuited for federal states; at the same time, the existence of the actual diversified fiscal policy on the territories, which leads to unfair competition both between taxpayers and territories.

This way, the existing system of fiscal federalism for municipal entities results in an extremely low financial support for their operation, considerable dependence (both financial and political) from the higher levels of power, income diversification and, therefore, different living standards of population depending on the municipal entity and its geopolitical and geographical location.

Scientific literature offers a wide range of opinions to the possible correction of the existing situation. For example, there is a suggestion to pass certain federal taxes or their parts (VAT, Mineral Extraction Tax) to the regions and municipal entities on a long-term and continuing basis, to establish an equal fixed tax payment splitting ratio in the majority of taxes at the levels of the budget system in such a way that the ratio between the federation and other territories is 45:65; to introduce a differentiated budget-building tax splitting ratio according to the territories etc. At the same time, the official position is that the existing system of the fiscal federalism is the best possible one, given the country's territorial differentiation in the area of raw materials, industry, nature and climate.

N.Yu. Isakova

STATE AND MUNICIPAL FINANCIAL MANAGEMENT

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Financial management can be represented as a process of administration of financial resources through the financial mechanism to achieve the stated goal. The term “financial management” is used, as a rule, primarily for private businesses when it comes to managing their cash flows for the purpose to increase profits. The very process of management in the private sector is sufficiently flexible to be able to respond quickly to changing external economic situation, changing needs of the market and competition. State financial management pursues entirely different purposes, is strictly regulated by law, and, therefore, is more limited in making certain financial decisions. Therefore, the term “financial management” began to be applied in the state sector relatively recently. For example, in Russia the definition of “public financial management” appeared in legislative documents only in the early 2000s. Since that time, the state began to develop a quality management system.

As already mentioned, the organization of financial management in state and private sector has significant differences. First of all, it concerns goals and objectives. For the private sector, the main objective is to satisfy the interests of the owner. For this purpose, financial management solves the problem of increasing the value of the company, profit maximization, cost reduction, providing financial sustainability and augmenting investment attractiveness. The main goal of a state is the satisfaction of social needs. Among its tasks are providing the state with financial resources to carry out its functions, effective use of the resources in the interests of the whole society; establishing reserves and so on.

One of the priorities of the Russian government today is the creation of effectiveness evaluation system of public financial management at all levels of administration. Key developments in the creation of quality monitoring in public financial management were initially conducted mostly at the federal level. To determine the financial effectiveness of federal authorities the priority areas were set as follows: quality evaluation of management in the implementation of the budget planning, budget expenditure management and organization of the state financial control.

For the subjects of the Russian Federation in the country is adopted and implemented the State Program “Creation of conditions for effective and responsible management of regional and municipal finances, increasing the stability of budgets for subjects of the Russian Federation.” This program provides a set of phased works aimed at creating an effective system of public financial management in the subjects of the Russian Federation. Such areas of financial management as the quality of budget planning, budget execution, debt obligations management, relationships with municipalities, the quality of state property management and the provision of public services, the degree of budget process transparency shall be subject to evaluation. At the municipal level the regulatory control

of public financial management in the Russian Federation is still at the beginning of its development.

For further high-quality development of public financial management it is necessary: to legislate the term of “State Financial Management”; clearly define the roles and powers of all participants in a budget process while organizing public financial management at all levels of government; upgrade a process of financial management quality evaluation at the level of all subjects of the Russian Federation, taking into account the specifics of their budgets, as well as at the municipal entity level.

E.G. Kniazeva

SUB-FEDERAL GOVERNMENT BORROWING IN THE RUSSIAN FEDERATION

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The budget system of the Russian Federation includes: the federal budget and budgets of state extra-budgetary funds; regional budgets and budgets of territorial state extra-budgetary funds; local budgets (budgets of municipal districts, urban district budgets, budgets of municipalities for the federal cities of Moscow and St. Petersburg); budgets of urban and rural settlements.

Each subject of the Russian Federation has its own budget. This pool of money is intended for the execution of expenditure commitments in the region. However, its using by state authorities of regions having other entity forms and spending money for the execution of expenditure commitments is not provided. A budget of a Russian Federation subject and a body of budgets of municipalities comprising the region form the consolidated budget. Herewith, inter-budgetary transfers between these budgets are not taken into account.

According to the budget classification, in sub-federal budgets are separately provided funds to be allocated for the execution of expenditure commitments emerging in connection with exercising powers on matters under the jurisdiction of regions and powers on matters of joint jurisdiction, as well as the commitments executed at the expense of federal subventions.

Government debt is liabilities arising from public borrowings, guarantees under commitments of third parties, other obligations according to the types of debt obligations established by the current legislation of Russia.

A structure of the public debt of a Russian Federation subject is the grouping of debt obligations of a region by specified types of debt obligations. Types of obligations in the region are in the form of commitments on: government securities of the Russian Federation subject; budgetary loans involved in the sub-national budget from other budgets in the budget system of Russia; loans obtained by the region from credit institutions, foreign

banks and international financial institutions; government guarantees of the region.

The public debt of a Russian Federation subject includes:

1. nominal amount of debt on government securities of the region;
2. principal amount of debt on loans received by the region;
3. principal amount of debt on budgetary loans involved in the sub-federal budget from other budgets in the budget system of Russia;
4. scope of obligations on the state guarantees granted by the region;
5. scope of unliquidated debt obligations of a Russian Federation subject.

This is the total volume of domestic government debt of the region.

Public external debt of a Russian Federation subject includes: the amount of debt on government securities of the region and obligations on loans, on state guarantees, unliquidated debt obligations denominated in foreign currency. Sub-federal debt obligations may be short-term (less than one year), medium term (from one to five years) and long term ones (five to 30 years).

Write-off of restructured as well as liquidated (repurchased) debt obligations from public debt of a Russian Federation subject shall be based on the legal provisions. Issues of government securities of the region, repurchased in full by their emitting authority in accordance with the terms of issuing securities before the maturity date may be recognized as early repayment.

Government domestic borrowings of the Sverdlovsk region are carried out in accordance with the State Internal Borrowing Program. During the execution of the regional budget the Government of the Sverdlovsk region may raise loans from the credit institutions in revolving credit lines, their limit not exceeding the scope of raised loans from credit institutions provided for in the legislation in force. During the execution of the regional budget it is allowed to raise budget loans from other budgets in the Russian budget system to replenish balances, provided that the amount of one such a loan does not exceed the total amount of raised budget loans from other budgets in the budget system.

State guarantees of the Sverdlovsk region are granted by the Government of the Sverdlovsk region, in accordance with the State Guarantee Program.

I.D. Kolmakova
A.S. Mikryukova
E.M. Kolmakova

THEORETICAL ASPECTS OF ENSURING BUDGETARY AND TAX SAFETY OF MUNICIPALITIES

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Legislative fixing of functions of municipalities in the sphere of ensuring activity of the population to local authorities demands considerable budgetary and tax resources. However, differentiation of municipalities on the level of budgetary and tax potential

leads to that the existing financial mechanism can't provide the sufficient level of the budgetary and tax income of all municipalities. Not all local budgets are able to guarantee performance by local governments of the social and economic functions assigned to them. Therefore, questions of providing and improvement of budgetary and tax safety of the municipalities are very actual.

Certainly, the problem of providing the measures directed on implementation of social programs, maintenance of the income, a standard of living of the population, employment, support of branches of the social sphere is solved at each level of management, but only at the level of municipalities the solution of questions of ensuring activity of local population, has prime value.

The solution of questions of local value depends on sufficiency of a financial basis of local governments and on effective management of financial resources of municipality. The municipal budget is the main source of ensuring account powers of municipality and the instrument of regulation of a production activity in the territory of municipality.

The volume of revenues of the local budget and its balance define prospects of social and economic development of the territory.

It is possible to carry to the factors interfering ensuring budgetary and tax safety of municipalities: discrepancy of volume of budgetary and tax resources and need for them, insufficient efficiency of municipal financial control, insignificant quantity of the taxes assigned to local budgets, reduction of their list and standard of assignments from regional and federal taxes, etc. We carry to the main indicators of ensuring budgetary and tax safety of municipalities:

1. share of the local tax and non-tax income in the total tax income, %;
2. share of the total tax income in the cumulative income of the budget, %;
3. the budgetary productivity according to the income, rub;
4. balance of the budget, %;
5. providing expenses under social articles own income;
6. a share of expenses under social articles in the total value of expenses, %;
7. quality of financial aid.

Using these indicators, it is possible to calculate an integrated indicator of budgetary and tax safety of municipalities.

In the Russian Federation reform of local government is carried out now. It is directed on creation of two-level model of the organization of local government at the level of the city district with intracity division. Creation of two-level model of the organization of local government will allow to balance budgets of municipalities in general.

S.A. Kolodyazhni

FEATURES OF ORGANIZATION OF SPECIAL ECONOMIC ZONES IN RUSSIA

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The role of special economic zones throughout Russian history, constantly changing, changed attitude of the leadership of the country, the scientific community and the business. Currently, however, we should state that they are beginning to play an increasingly important role in the development of the country. The scale of the SEZ in modern Russia can be judged according to the Government of the Russian Federation [66]:

- In 2013 the volume of investments in the SEZ 30.2 billion rubles, which is 12.7 billion rubles more than in 2012;
- Volume of proceeds the residents of 50 billion rubles (in 2012 - 29.7 billion rubles);
- Residents of jobs created 3145 (in 2012 - 1814 jobs);
- More than 2-fold down the rest of the unused funds of JSC "SEZ", which, as of January 1, 2014 amounted to 14 billion rubles (January 1, 2013, the figure was 34.6 billion rubles);
- Decreased amount of funds not encumbered contractual obligations: to 22.4 billion rubles (as of 1 January 2013) to 3.7 billion (as of 1 January 2014).

In Russia, at the moment there are 17 SEZs, but their condition is different. Some are already under way to produce and are a variety of residents in other work on infrastructural support.

The current focus areas to some extent open to review. Website SEZ [122] provides a wide range of information about the activities of the regional offices and the development strategy of the agency. Each SEZ has its own source of information on the Internet, in which publicly available information is available to potential investors and other user groups. It should be noted that information transparency is a necessary condition, it shows the "transparency" of activity in the SEZ, shows the real conditions of doing business.

Failure in creating zones in the early 90s, when they were not given the real development of the economy, and for the most part associated with the ability to evade taxes, led to that and now some politicians and academics set negative with respect to the appropriateness of large-scale application of the present economic paradigm. For objective evaluation of the establishment of special economic zones in the country are encouraged to use an evolutionary approach to the formation of the SEZ, which takes into account the different institutional framework for the formation of zones in different periods of the existence of the state. In this case, currently more important to consider

the possibility of further development of the SEZ in Russia. There are several options:

- Restrict already existing zones;
- Create new zones SEZ;
- Switch to other mechanisms of development;
- To integrate the area between them.

There are no clearly defined public policy priorities for the establishment of special economic zones in the territory of our country.

It can be concluded that all the development goals are quantitative. Besides it is not specified, due to what will be achieved the intended result, besides the absence of intermediate indicators does not allow control of performance goals. Such strategies are currently available and most of the other regional governments SEZ, but they are not built into a single concept, and the strategy of their development in the long run is to establish quantitative targets.

A decisive role in the successful operation of the SEZ will play the availability of sufficient human resources. Activities of SEZ provides a completely different requirements to the labor market, the level of skills. Creating a high-performance workplaces are often not successful due to lack of sufficiently qualified workers. As the experience of creating SEZ in Russia for most of the frames need retraining to start working in enterprises in the SEZ. In such circumstances, scientific and educational organizations will be essential tools for ensuring the success of the SEZ. Proportion of population with higher education in the workforce in the region, which creates a SEZ, is the most important criterion for choosing a site for the creation of zones. Not surprisingly, almost all created in the Russian zone are located in regions with a high educational level.

Establishment of the SEZ itself assumes the appearance of additional jobs at the same time there is a need for additional labor and personnel to ensure the normal functioning of the SEZ, is not directly taken into account in the calculations. This stream can be called multiplicative, and its size depends on the characteristics of the area, but in some cases it may be several times the number of jobs created in the zone itself (eg in the Stavropol region is expected that the multiplier effect of 40 thousand. Jobs when the number of jobs zone 11 th.).

Thus, there should be the concept of staffing functioning SEZ taking into account not only the needs of the zone, but there is an additional staffing needs. SEZ development should take into account the social dimension, in particular the need to solve the problem of housing for employees zone. Often, the success of the area is necessary to attract staff from other regions. In Tatarstan, this problem is solved using the address rental housing and housing for sale in the mortgage. In Zelenograd also faced with a similar problem, and it will be solved by the construction of apartment buildings.

Talantbek Namazbekov
Larisa Shulgina

TYPOLOGY OF NON-ECONOMIC FACTORS IN ECONOMIC GROWTH

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Economic state development is a consequence of various factors, the number of which increased in accordance with increasing relations among the economic agents. The economic system is one of the subsystems of the society in which is possible to allocate social, political, ideological, religious, military, cultural, scientific subsystem. Criterion given by us a typology of subsystems is authority as behavior social actors.

Behavior as a means communication and mode of expression of will of the subject to the action applies to all subsystems of society, including economic. Behavioural characteristics are common to as individuals and to as impersonal abstraction personalized by the authorized individuals (state, municipality, public organization and company). Economic development is the cumulative result of vector behavior of actors in society to achieve the objective of economic growth. Depending on the type of economic growth is defined its purpose, with the positive dynamics generalizing economic indicators may not be immediately, and for a specified time.

In accordance with the subsystems of society can be identified factors that appear directly in the economic subsystem and influence its development, and - influences of neighboring subsystems, which, being inside the system of the society participate in economic development.

Researchers Gorshkov M.K., Sedyukova E.A., Bezglasnaya E.A., Ipatov P.L. alongside economic factors the growth of national economy allocate noneconomic factors: information; physical and geographical conditions; institutional structures; political; innovation and technology; psychological.

These authors soundly formed a group of non-economic factors, some factors (institutional, physical geography, innovation and technology, psychological) repeat, each other that testifies to their obvious and undoubted influence on economic growth. Moreover, all the authors cite as an important psychological factor. We would like, while not rejecting the proposed typologies to introduce intra-elements, which have an undeniable influence on the economic development of society. Based on our analysis of the most important intra-system factors of economic development are the demographic and stratification, which carry economic and non-economic content.

These factors include age and gender population groups their dynamics, including the dynamics of the economically active and employable population. A major role is played by professional and production strata, as well as - the strata of income- education, ideology, culture (subculture), the dynamics and the role of risk strata (drug addiction, crime, prostitution and migration groups), the presence and size of marginalized groups (beggars and etc..).

It is the dynamics of demographic characteristics and stratification of society, the direction of transformation of social structures bear in themselves multiplier effect, directed on development or collapse of economic processes.

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ENTERPRISE OF MANAGEMENT AS A SUBJECT AND ITS ROLE IN GLOBAL INTEGRATION

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Globalization is an objective factor in world development, it can not be suspended or eliminated politically or economically means. Global processes actively influence the all of the economic relationships and generate new forms of economic relations. This also applies to the integration of business entities.

We, bearing in mind the criterion of geography integration processes, identify two areas of integration: national and international. Both processes are nothing new in recent years. Integration of entrepreneurial resources in the national and international context occurred in the Middle Ages as a union of capital participants from different countries - have worked so kommandit partnerships. In the late XIX-early XX century actively formed the same direction of integration in the form of joint-stock companies, concessions, various forms of monopolies. However, due to the change and the increasing complexity of economic relations and forms of cooperation also change the form of integration.

From our point of view, globalization is a form of realization of the essence of multinational enterprises and the dominant monopoly in the identities of the contracts, both entrepreneurs and employees of enterprises. Here it is necessary to clarify what we mean by a dominant monopoly in the personality structure. Monopoly, we believe individual values and abilities of the person, he established in the socialization process, the dominant monopoly is what distinguishes one individual from all others. In the economic sphere, this property receives a form of monopoly, that is, the unique activities. However, all human values can not be a monopoly - or social component of identity disappears. Monopoly in this sense, has the highest value. If such a monopoly is involved in socialization and in the public domain, its value is reduced, and the price for it falls. Dominant monopoly in person allows that person to take a controlling position, the competition is only the exchange of values that are either no longer a monopoly, or no information about it. Then transaction costs - the costs of keeping it private monopoly in any form: the monopoly of technology, the monopoly of property rights, the monopoly of information and so on. Organizational structures that are formed at the same time, act as a unity of monopoly and the public began. Thus, the interconnect needs and abilities of the individual to the organizational structure of the economy, including those that are formed integrative.

By definition, many foreign authors the nature of the company related to the size of contracting. Chen C., in particular, argues that the size of the firm depends on the contract - hence the possible division into a unitary (solely) company and a coalition of owners of resources. R. Coase believes that the firm is an alternative system of organizing production through market transactions, the firm is an alternative to individual entrepreneurs, provided that its transaction costs are lower than that of individuals.

O. Williamson understands by coalition by owners of factors of production, interconnected web of contracts, which results in a minimization of transaction costs.

T. Eggertsson writes about the definition of the nature of the firm: "In the new institutional economic theory of the firm is defined as a network or plexus contracts. ... The definition of firm in NIE should not be considered a clear ... Instead of trying to give a clear definition of what constitutes a company more productive would be to analyze a variety of contractual forms to try to discover the determinants of these forms and their implications for equilibrium outcomes.

In other words, foreign researchers are not intended to consider the nature of the economic potential of the primary element of the system, as a business education company. NIE (New Institutional Economics) is more busy processes occurring with these entities in the system, that is, the processes of formation and development of economic institutions, investing in their content of the implicit contract between the owners interspecific resources, leading to the minimization of transaction costs. Hence, the purpose of domestic or foreign company in any case, it is reducing the costs associated with the transfer of ownership of resources in the process of market exchange. Foreign researchers, describing the firm actually define target setting operation of the business. This does not diminish the role of people in the firm.

Talk about the factors of contracting enterprises can only finding out the essence of the enterprises themselves. After all, the company, with signs of a legal entity, are essentially fictitious institutional education, de jure exists separately from its founders, managers and the workforce (including their possible turnover), and de facto - including organizational, technical, technological and material relations founders, partners and members of the workforce.

Between the parties, there are contractual relationships as a set of rules, conditions, forms, agreements between economic agents, as well as - the availability of population control and security in good faith the obligations of contracts governing the interaction between the market. Creating a contract system based on the use of contractors in-depth information regarding the transaction. Introducing the category of transaction costs was due primarily to the works of Ronald Coase, as from the classical content of the category "costs" were excluded as information and transformation costs.

It seems to us that the company is co-operatives rather than physical capital, many people with unique (exclusive) labor, operational, technological, and organizational skills, able to create the network of contracts, which the researchers say NIE. After all, the head of the enterprise, the entrepreneur or top manager, signing contracts with partners, guided

by their own ideas about the sense in which for him is less than the transaction costs, and in what sense - more. Man as a biosocial being creates a company to consolidate the dominant monopoly (individual) capacity and adequate needs of themselves, their co-founders and employees. Without the human factor creating this kind of enterprise - it "dead". Such consolidation may participate in the competition with other consolidations. After competing always unique, essentially a monopoly value. Plays the role of the state to protect human monopoly firm of opportunists, that is, those firms or individuals who in the course of the exchange of monopoly values (and it is valuable monopoly properties, products, services, etc..)

Integration into the global world is a form of manifestation of the dominant personality of the people (entrepreneurs or employees) that interact in this space. Over the past 50 years, new forms of enterprise integration in the international sector. Despite the fact that Professor Yu Belianinov believes that in today's world is the so-called double integration, world or global economic integration generated by processes of transnationalization and globalization; traditional and regional integration, developing in certain institutional forms since the 50s. [6], should pay attention to the degree of integration or the degree of interpenetration of the mechanisms of economic entities participating integration. In the same extent that the integration takes the form of enterprises, adequate expression of the dominant personality of entrepreneurs and their teams, international forms of integration of acquired characteristics of the integration of economic entities, their formative. So, it is advisable to international integration appears when exhausted the possibility of integration within the country and put in place not only inside, but also international infrastructure. We can also call the integration of the formation of special economic zones, the species, which contribute to the diversification of the economy.

A.V. Shulgin
L.Y. Shulgina

PUBLIC-PRIVATE PARTNERSHIP IN THE FIELD OF EMPLOYMENT

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The Russian citizen has several choices of employment for income, involving the state, private and public organizations.

The first variant - receiving public services in the area employment promotion. Measures of active employment policy related to the powers of state authorities of the Russian Federation and are being implemented through state employment services. Citizens in search of a suitable job free familiarize with the database of vacancies in any employment center. Employers provide the content of the database, which is fixed and

regulated by the labor legislation of the Russian Federation, including the Law “On Employment of Population” (from 19.04.1991 No. 1032-1). Also in the Voronezh region the state program “Promoting employment of the population”, which envisages the provision of citizens, including socially vulnerable population groups (the unemployed, parents with disabled children who are released from prison, disabled, etc.) vocational guidance services, retraining, social adaptation and psychological support, organization of public works, temporary employment of minor citizens free from study time, the promotion of entrepreneurship, as well as several other functions.

The second variant of employment - self-employment of citizens in their own business. Self employed are responsible for paying their taxes and insurance contributions while in the hiring of these issues are dependent by the employer. Income of self-employed people are directly dependent on their business activities.

The third option is the employment hiring through private recruitment agencies, recruitment companies. They have their own database of vacancies. The basic business model of staffing companies built on selling information from the database summary. The largest and most well-known companies on whose sites, according to official statistics services, come every day more than 1 million. Persons: HeadHunter, SuperJob, of Rabota.ru.

In its turn it should be noted that on the information portal “Working in Russia”, created by the Federal Service for Labour and Employment declared more than 1.5 million. Vacancies and a little more than 17 thousand Resume. In this case, visible the reverse situation - vacancies in order of magnitude larger than there is of registered job seekers.

Visible differences in the actions of private partners and state -posrednichestvo job search and employment. In one case - profit, in other socially-orient results.

Here is an opportunity to apply the principles of public-private partnerships to effectively search the worker by the employer and the worker by the employer in the case of combining the information space of public and private databases of vacancies and employers. That is, to create a single information space. On this basis, the concept of a common information space will help in achieving the goal by meeting all participants. To implement this project, in practice, it is necessary:

- Confirmation of the order of creation, content and information resource management at the legislative level;
- Technical support for the project, which could take over private capital;
- Reduction of bureaucratic barriers authorities in respect of all participants in the project;
- State regulation of prices set by the recruitment agencies for employers.

E.A. Smorodina

TAX METHODS TO PROMOTE INVESTMENT IN THE RUSSIAN FEDERATION

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In Russia one of the main tasks is creation of a favorable tax climate for investment activities.

A possibility of providing additional tax incentives to encourage investment activity in the RF is estimated ambiguously. One of the main obstacles to the introduction of additional tax incentives is the possibility of their use by enterprises having no relation to the investment processes in the Russian economy in order to obtain an unjustified tax benefit. Of course, this can reduce the efficiency of tax incentives and Russia will get a negative effect of their introduction. Therefore, the tax stimulation of investments in the Russian Federation has to have a selective character. It is necessary to enter the tax incentives which will allow increasing competitiveness of the Russian economy.

Currently, the effective legislation of the Russian Federation provides the following types of tax incentives for investing activities:

1. investment tax credit;
2. depreciation of fixed assets, application of the accelerated depreciation, "bonus depreciation" for the profit taxation;
3. disclosure of R & D costs within other costs recognized in profit taxation;
4. reduction in the rate of the profit tax payable to the regional budget;
5. granting the right of introducing lowered rates and side benefits on the corporate property tax to territorial subjects of the Russian Federation;
6. R&D and intellectual property right sales VAT exemption;
7. exemption from VAT on carrying out R&D at the expense of budgets of scientific, scientific and technical, and innovative activities supporting funds created according to the Federal Law dd. 23.08.1996 N 127-FZ "On science and the state scientific and technical policy" (since 01.01.2014);
8. reduced rates of the insurance fee payable to the Pension Fund for the organizations engaged in software development.

The main laws aimed at stimulating investment activities in the Sverdlovsk region are as follows:

1. «On the state support for subjects of investment activities in the Sverdlovsk region».
2. «On a rate of the corporate profit tax for specific categories of taxpayers in the Sverdlovsk region».
3. «On corporate property tax assessment in the territory of the Sverdlovsk region».

According to the Federal State Statistics Service, in 2012 the Sverdlovsk region was ranked 27th for investments in fixed capital per capita (for foreign investments it took

11th position) among the subjects of the Russian Federation. Among the industrial RF subjects the Sverdlovsk region was ranked 12th for this indicator (for the level of foreign investments in fixed assets per capita it took 3rd place). However, the index of the physical volume of investment in fixed assets was 104,9% in the Sverdlovsk region. In 2012, the Sverdlovsk region took 25th place for the share of profitable enterprises among the Russian Federation subjects, and it was 13th among the industrial regions of Russia.

Improvement of existing methods for applying tax incentives in encouraging investment in Russia should be aimed at simplifying their application in practice and achieving their convenience and transparency. This, in its turn, will allow simplifying evaluation of their efficiency and evaluation of tax losses for the budget as a result of introduction and practical application of a tax privilege.

V.P. Stupnitsky

PSYCHOPHYSIOLOGICAL REQUIREMENTS TO PROFESSIONAL SELECTION OF STAFF WORKING UNDER SPECIAL CONDITIONS

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One of the directions in the improvement of methods of professional psychophysiological selection of staff in ergatic systems working under special conditions is a wider application of methodological techniques for a study of personalities and their specific reaction characteristics in non-routine situations.

In the opinion of researchers (V.A. Bodrov, G.M. Zarakovsky, B.L. Pokrovsky etc.), an important condition of the psychophysiological staff selection is the determination of objective criteria in regard to the staff professional aptitude for work under special conditions. These criteria are not strictly established and may change under the influence of a series of conditions, e.g. structure parameters and activity conditions, time and characteristics of the education or training process and socioeconomic possibilities of organising the practical procedure of staff selection.

For this reason, it is necessary to divide the total selected management force into three groups: fully fit, fit on a provisional basis and unfit. Fully fit management staff are people who will be able to withstand destabilising factors, operate actively and manage the staff with a high degree of certainty (probability), i.e. to effectively perform their professional duties under special conditions.

The group of management staff who are fit on a provisional basis consists of two categories of people. The first category contains people about which it is possible to predict that they will cope with their professional duties under special conditions, but their work might have some isolated failures and mistakes caused by changes in the parameters of the destabilising factors. At the same time, these mistakes will only lower the reliability and general efficiency of the functioning system to an insignificant extent. The other category

consists of people who require strict management, control and support in case of special conditions. In this case, their work has a subordinating character and is strictly regulated by in-house rules of the ergatic system operation.

The analysis and summary of the results from the previous experimental research in this area makes it possible to formulate a series of general principal methodological statements in regard to the development and implementation of measures for a professional psychophysiological selection of management staff in ergatic systems.

The professional selection has to be comprehensive, i.e. the assessment of the professional aptitude for working under special conditions has to be carried out in regard to physiological, psychological, sociological and other parameters. It requires a further examination of interrelation, interdependence and mutual compensation properties of professionally important personal characteristics.

The psychophysiological selection has to be active, its results should also be used for the adaptation of technical systems to human psychophysiological possibilities and for the improvement in the quality of staff preparation and training for working under special conditions. Furthermore, it must be based on the principle of a differentiating forecast of the main structural elements of management activity and determining personal characteristics. The psychophysiological selection must also be a dynamic and prolonged procedure with the objective of an uninterrupted information acquisition about the state and change (development) characteristics of professional qualities in order to regularly improve the accuracy of forecasts of the successful professional activity, due to potential changes in its structure and level of psychophysiological requirements for the staff training in ergatic systems.

G.G. Sukhanov
R.E. Makoveev

EVALUATION OF THE EFFECTIVENESS OF SUBSIDY PROGRAMS OF LEASING OPERATIONS AND THEIR IMPACT ON BUSINESS ACTIVITY IN THE ARKHANGELSK REGION

Northern (Arctic) Federal University, Arkhangelsk, Russia

State support of small and medium-sized business entities is a separate subject of government policy in Arkhangelsk region and Russian Federation. It is based on the principle of creating favorable conditions in those kinds of business activities, which give the maximum socio-economic effect.

In spite of overall positive trend of growth of business activity of small and medium-sized business entities and the growth of economic indicators from its activity in general, the sphere of active state support in the Arkhangelsk region now is not well developed.

One of the major factors that restrain business development small and medium-sized business entities is the lack of financial resources for the development of business. In addition, for many small and medium-sized businesses financial leasing is the only way

to get investments for the acquisition of fixed assets and further development of their entrepreneurship. Support from the government to subsidize the leasing operations is an additional stimulus for the leasing mechanism for updating or purchasing of the fixed assets by small and medium-sized enterprises.

Arkhangelsk region belongs to the group of regions where such subsidies are enshrined in law: small and medium-sized businesses (producers of goods, works and services) at no cost and irrevocable basis receive financial support through subsidy on a competitive basis. There are two programs in the region:

- subsidizing of the part of lease payments under financial leasing agreements concluded for the implementation of investment projects;
- subsidizing of the down payment in the contract of financial leasing of production equipment and machines.

Sources of funding the programs are the federal and regional budgets.

Financial leasing is already a mechanism for improving the economic situation through targeted investment in fixed assets. The main purpose of the article is to determine the effectiveness of government support programs of leasing operations in our region excluding the impact of the leasing advantages as the mechanism

The key question of any action is the degree of achievement of its objectives, its effectiveness, i.e. the rate of reduction to the desired results.

Today, there is no complete system for evaluating these programs, which are held as in the Arkhangelsk region, so in other regions of the Russian Federation.

In this article, evaluation of programs is carried out by an analytical approach, based on the overall benefits for all the support, in terms of the general economic benefits in the following main groups of criteria:

1. Relevance to the objectives and overall program evaluation
2. The presence of external effects of programs
3. The social significance of programs and other criteria

Municipal support of lessees (small and medium-sized enterprises) is an effective way of supporting the developing companies, as well as stimulating investment activity of enterprises in the region and improving the efficiency of usage of budget funds. These programs have high multiplicative and socio-economic effects, what assists modernization of technological processes and increasing assets of enterprises.

G.G. Sukhanov
T.L. Razdoburdina

THE MODEL OF EVALUATION OF FINANCIAL SUSTAINABILITY OF THE REGIONAL BUDGET

Northern (Arctic) Federal University, Arkhangelsk, Russia

The main purpose of this study was to create the model for evaluation of financial sustainability of regional budget. We used a combination of quantitative and qualitative

methods. As a situation in the region has to be studied in dynamics, only qualitative research in the form of interviews was not enough, statistical information and legislative documents also have to be studied. In the analysis of existing models identified the following main shortcomings:

- The lack of a summary measure that could assess the financial sustainability of the budget in a certain period ;
- The lack of normative values of the coefficients used , which makes it possible to compare them only in the dynamics or between regions , but does not allow to draw conclusions about the state budget at some point ;
- The application of the absolute values of the indicators in the assessment of financial stability makes the comparison between the subjects of the Russian Federation.

This paper presents the evaluation model , which takes into account the shortcomings presented . The model is based on the calculation of the coefficients , which eliminates the effect of differences in absolute terms between budgets . Each of the coefficients assigned to the standard value (perfect condition) , and then using the weight coefficients determined a single composite indicator assessment ranking which allows to estimate the level of financial stability of the territorial budget . Feature of this model is also the fact that the calculation does not take into account the subvention received since they inherently are not considered income and expenditure of the budget , as submitted for use , that is, the budget is the agent for their transfer . Thus, the model uses the concept of own budget revenues (revenues minus subsidies) , as well as the notion of their own expenses , defined by analogy.

The proposed model can be used both to assess the financial stability of the individual subject of the Russian Federation at some point, to assess trends of its changes over time and comparing the position of the territorial budget with the budgets of other regions , and for the characteristics of the entire budget system of the Russian Federation , in particular efficiency and uniformity of the distribution of intergovernmental transfers to the regions.

G.G. Sukhanov
E.V. Sukhanova

THE BUDGETARY PROGRAMS IN THE SPHERE OF SMES AND THE EFFECTS THAT THEY HAVE ON THE DEVELOPMENT OF ENTREPRENEURSHIP IN ARKHANGELSK REGION

Northern (Arctic) Federal University, Arkhangelsk, Russia

In the Budget Message of the President of Russian Federation for 2011 - 2013 the problem of coordination between strategic planning and budget planning was highlighted: "Budgets don't really show how strategic plans will be achieved, and programs are not aimed to achieve strategic goals". That's why one of the most important requirements that the government of the Russian Federation has to the program budgeting is to integrate budget planning into strategic planning "The strategy of Socio-Economic development of Arkhangelsk region until 2030" was adopted in October 2008 One of the aims of the

strategy of socio-economical development of Arkhangelsk region until the year 2030 is “to create conditions for the development of entrepreneurship and self-realization of people”; and all the performance indicators of the program “On the development of SMEs in AO and NAO for 2012-2014” are targeted to achieve this aim. These two programs are linked directly to the strategic goals of socio-economic development, so it helps to integrate strategic planning with budget planning.

According to investigation on SMEs conducted by “Opora Rossii” in 2010:

- regional programs on support and development of SMEs in AO are developed considering entrepreneurs’ opinion;
- programs are discussed in the public;
- projects of the programs are published in media and discussed at the meeting of Advisory Board.

The program documents, budgets and official web-page of support of SMEs present the tasks and results of the programs in the formal way. In order to understand the real situation with SMEs in the region, it is necessary to find out if entrepreneurs really feel improvements and how they evaluate the state’s support of SMEs. The report of non-profit organization “Opora Rossii” about the conditions of development of entrepreneurship in different regions of Russia presents the following results of a survey made among entrepreneurs of Arkhangelsk region: On the question “How strong is attention of the regional administration to the development of SMEs in region?” 2% of entrepreneurs found it difficult to answer, 42% stated that the government pays attention but that it is usually not enough, 27% that the government pays little attention, and 29% that the government pays no attention. 73% of entrepreneurs know about programs in the sphere of SMEs in the region, but only 24% take part in them. The most serious problems for Arkhangelsk region are connected with the deficit of qualified employees (46% of entrepreneurs), 34% of entrepreneurs find the taxes to be very high, 20% feel difficulties with the access to financial resources. The region also lacks both industrial and commercial premises and there exist difficulties with getting land for construction and with providing necessary infrastructure. Moreover, high tariffs of natural monopolies (energy and water) and constantly changing legislation on the federal level hinder the development of SMEs in the region.

E.K. Tkhakushinov

DAS SYSTEM DER STEUERUNG VON INVESTITIONSRISIKEN AUF DEM MESONIVEAU

Staatliche Technologische Universität Maikop, Russland

Die Steuerung der Investitionsrisiken auf regionalem Niveau stellt einen wichtigen Teil der Versorgung der resultierenden Ertragsfähigkeit der Investitionen Tätigkeit an den Grenzen von territorial-lokalen ökonomischen System des Mesoniveaus dar. Es ist bekannt,

dass das Hauptziel des Investierens auf jedem Level, Maßstab und Typ darin liegt, in einem Zeitraum Gewinn zu machen, der abhängig von der konkreten Investition lang-, mittel-, oder kurzlebig sein kann. Risiken sind Begleitumstände einer solchen Tätigkeit, die abhängig von dem Management unterschiedliche Ergebnisse haben kann; wie die Bedrohung des Nicht-Erreichens der prognostizierten Gewinne oder das erleiden von Verlusten und die potenzielle Möglich des Erreichens eines zusätzlichen Gewinnes. In Verbindung dazu kann es dazu kommen, wenn die Investitionsrisiken nicht kontrolliert werden, dass man den Gewinn nicht erreicht oder er wesentlich niedriger ausfällt. Im Gegensatz dazu dient das Managen von Risiken nicht nur dem Vorbeugen von unangenehmen Folgen, sonder auch dem Erlangen eines Gewinnes über den Erwartungen.

Zum Managen der regionalen Investitionsrisiken können eines der zweite Konzepte gewählt werden: statistische oder dynamische Verwaltung. Das statistische Management ist größtenteils mit der Wahrnehmung des Konzeptes "Risiko" als Synonym für "Gefahr" verbunden und ist darauf bedacht die Folgen zu neutralisieren oder den möglichen Verlust zu verringern. Dabei trägt das Management einen sporadischen Charakter, der sich auf Situationen des Erkennbaren Risikos, die nicht vorher erforscht wurden und zu meist nicht vorhersehbar auf Grund der fehlenden Bestrebungen zum Risikomanagement und der fehlenden Informationen sind, sowie vorbereiteter Fachkräfte, begrenzt. Ein solcher Typ des Managements bedroht "faktisch" die Investitionsattraktivität einer Region oder sein Investitionspotenzial und begrenzt die Ausarbeitung und die Realisierung des einzelnen leitenden Einflusses. Die Grundlage seiner Akzeptanz ist die zugängliche Information und zu einer zusätzlichen Sammlung von Informationen oder Analyse kommt es selten. Das statistische Konzept des Managements der Risiken aller Art, einschließlich Investitionen, ist das historisch erste, da bei jedem Faktor der Erfahrung der Entscheidungen treffenden Person, Gefahren aufkommen können, die dem Erreichen des gewünschten (prognostizierten) Gewinnes schaden und das Bedürfnis Ihrer Beseitigung oder wenigstens die Senkung der nachteiligen Folgen aufkommen lassen würden. In diesem Fall trägt das Management der Investitionsrisiken einen taktischen Charakter, da man sich auf die Erfüllung von kurzzeitigen Zielen einstellt, ohne sich auf die Zukunft zu orientieren. Es ist offensichtlich, dass solche Konzepte des Managements der Investitionsrisikos auf regionale Ebene inakzeptabel sind, da nicht nur verboten wird mit dem Risiko zu manipulieren, um die Einnahmen zu steigern, sondern es auch ineffektiv bei der Senkung der Verluste ist.

In Verbindung zu den nötigen Voraussetzungen zum Bestehen des Phänomens des Managements der Investitionsrisiken einer Region steht seine Verwirklichung auf Basis eines dynamischen Konzeptes, ein regulärer Prozess. Dabei soll es zu einer ständigen Überwachung der Risiken und der Anpassung der Einflüsse in Übereinstimmung mit den Veränderungen der Investitionsrisiken einer Region kommen. Anders ausgedrückt wird das dynamische Konzept der Leitung des regionalen Investitionsrisikos nicht wie ein einzelner Akt, sondern wie ein Prozess realisiert. Sie stellt die Realisierung des aktiven Verhaltens des Paradigmas zu dem Risiko da, d. h. ihn nicht als Bedrohung, sondern als eine Möglichkeit für einen zusätzlichen Gewinn wahrzunehmen. Folglich schließt es

das Prognostizieren und Bewerten der Ergebnisse der getroffenen Entscheidungen und realisierten leitenden Einflussnahmen ein.

Auf diese Art ist der dynamische Ansatz nicht das passive Erwarten der Folgen in einer riskanten Situation, sondern das Management mit dem Ziel sich einen potentialen Investitionsvorteil zu verschaffen.

Ein solches Management verlangt sowohl taktische, als auch strategische Entscheidungen.

L.I. Yuzvovich

**CONCESSION POLICY TO ATTRACT INVESTMENTS
IN THE FRAMEWORK OF PUBLIC-PRIVATE PARTNERSHIP**

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In the context of the financial and economic crisis, an instrument such as the concession should encourage more active use of the investment opportunities of the state and private business, raising funds directly to the regions, the effective use of both state and municipal property. Optimal is the involvement of regional and municipal authorities in the development of concessions: they have sufficient authority and knowledge of their own territory.

The empirical analysis shows that the value of real investment projects on the investor's share of the concessionaire accounts for 65 % of the funds (including 37 % for investor's equity and 28 % for borrowed funds).

Thus, the real investment projects realized with state support at the expense of budget allocations of the Investment Fund of the Russian Federation play a significant role in the Russian investment business and are focused mainly on construction and reconstruction of strategically important objects of the national economy, as well as infrastructure development. The share of participation of the Investment Fund of Russia in real investment in the national economy is about 30 %, the volume of funds of subjects of the Russian Federation is insignificant and amounts to about 6 % of the total value of real investment projects, which arose on the basis of public-private partnership.

The main advantage of real investment projects with participation of the state at the expense of budget allocations is that the optimization of budget expenditures is carried out during the construction phase due to attracting off-budget investments in the framework of the concluded concession agreements, as well as during the operational phase due to laying the operation costs for project infrastructure maintenance on a concessionaire.

The launch of concession arrangements in Russia will create serious budgetary implications.

First, it will mean the inflow of investment and the increase in tax revenue from concession projects.

Secondly, it will entail a change in government expenditures. On the one hand, investment costs will be reduced (at the expense of private investment). On the other hand, the transition from a state management model to public-private partnerships leads to significant cost reduction in any country of the world.

Third, legalization of concession arrangements in Russia will require the creation and introduction of a Tax Code chapter on special tax regime for concessions.

In their turn, there are disadvantages of concession activities as a public-private partnership in the field of investment, as follows:

- the disappearance of incentives for efficient investor's operation when the subsidies substituting for consumers' payment for services are not dependent on production efficiency;
- the probability of adverse selection - the complete "insurance" may cause investors to look for projects with excessive risk, as they know that it will be covered by the state;
- higher expectations of making ineffective decisions in public institutions than in private ones, especially in transition economies;
- financial constraints - the state does not have the means to fully participate in large-scale investments.

Financial mechanism of the concession agreement can play a positive role in investment processes, consolidate the positive trends and take the path of sustainable economic growth.

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European Academy of Natural Sciences (Hanover)
European Scientific Society (Hanover)
Russian Academy of Natural Sciences, Moscow

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