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# "ÖKOLOGISCHE, TECHNOLOGISCHE UND RECHTLICHE ASPEKTE DER LEBENSVERSORGUNG"

# Programm Abstracts

Europäische Akademie für Naturwissenschaften, e.V. Hannover Europäische Wissenschaftliche Gesellschaft e.V Hannover

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## IMPROVEMENT OF THE LUBRICATING PROPERTY OF HYDROTREATED DIESEL FUELS

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It is known that lubricating property of hydrotreated diesel fuels is low and now the uses of additives for preventing abrasion is the most real way to enhance its property.

The influence of stearic acid imidazolines to the lubricating property of low-sulfur diesel fuels were studied in the present research paper. Hydrotreated diesel distillate was used as a basis of diesel distillate. It was revealed that according to lubricating property (0.567 mm) basis of diesel distillate does not meet requirements ( $\leq 0.460$  mm) of modern diesel fuels.

In the research paper amino- and hydroxyethyl imidazolines were used which were synthesized by reaction of stearic acid-diethylenetriamine and N-(2- hydroxyethyl) ethylenediamine. Structures of both imidazolines are given below:



2-stearin-N-(2-hydroxyethyl)imidazoline (Im-I) 2-stearin-N-(2-aminoethyl) imidazoline (Im-II)

Structures of imidazolines were detrmined by NMR and IR spectra.

According to <sup>1</sup>H NMR spectral studies of 2-2-stearin-N-(2-hydroxyethyl)imidazolin e(Im-I) at the CDCl<sub>3</sub>  $\delta$  0.87 (3H, t, CH<sub>3</sub>),  $\delta$  1.27 (30H, s, CH<sub>2</sub>, C<sub>3-17</sub>),  $\delta$  1.55 (2H, t, **a**-CH<sub>2</sub>),  $\delta$  1.64 (2H, s, NH<sub>2</sub>),  $\delta$  3.52 (2H, t, CH<sub>2</sub>–OH),  $\delta$  2.85 (1H, s, OH),  $\delta$  2.79 (2H, t, N–CH<sub>2</sub>),  $\delta$  3.38 (2H, t, CH<sub>2</sub>–N),  $\delta$  3.67 (2H, t, CH<sub>2</sub>N=C) was determined. According to <sup>13</sup>C NMR spectral studies  $\delta$  165.3 (-N=CR-N-),  $\delta$  50.7 (-CH<sub>2</sub>-N=CR-),  $\delta$  54.7 (-CH<sub>2</sub>-N=),  $\delta$  53.6 (=N-CH<sub>2</sub>-)  $\delta$  58.6 (-CH<sub>2</sub>-OH),  $\delta$  26.3 (**a**-CH<sub>2</sub>),  $\delta$  23,2 ( $\beta$ -CH<sub>2</sub>),  $\delta$  29.1 (CH<sub>2</sub>, C<sub>4-15</sub>), 32.4 ppm (CH<sub>2</sub>, C<sub>16</sub>), 23.7 ppm (CH<sub>2</sub>, C<sub>17</sub>), 15.2 ppm (CH<sub>3</sub>, C<sub>18</sub>) was found. The IR spectrum reveals that C-H bands of CH<sub>3</sub> appears around 2842 cm<sup>-1</sup>, C-H bands of CH<sub>2</sub> of alkyl fragment around 723 cm<sup>-1</sup>, O-H bands of OH fragment around 3355 cm-1, C-O bands of CH<sub>2</sub>-OH fragments around 1059 cm<sup>-1</sup> and C=N bands of imidazoline chain around 1610 cm<sup>-1</sup>.

Im-I and Im-II were added to diesel fuels in definite proportion(0.005-0.05%) and then wear spot diameter (WSD) of diesel fuels were measured to study influence of additives into lubricating property of them. WSD was measured three times for each concentrations and average number was calculated.

It is revealed that addition of both two imidazolines to diesel distillates shows positive effect on lubricating property and those diesel fuels meet requirements of modern diesel fuels according to wear spot diameter (WSD≤0.460 mm).

On the other side, comparison of lubricating property of Im-I and Im-II added diesel fuels shows that influence of Im-I to the lubricating property of diesel fuels is more than that Im-II. It can be explained by polarity of OH group of Im-I is more than  $NH_2$  group of Im-II. This fact is shown in the study of infulence of alcohols and ethers to the lubricating property of diesel fuels. It was discovered that alcohols have better effect than ethers to the lubricating property of diesel fuels.

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### INVESTIGATION OF MONOGLYCOL ESTERS OF ACIDS DERIVED FROM VEGETABLE OILS AS OXYGENATED ADDITIVES TO DIESEL FUEL

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It is known that today high ecological damage of fuels and their exhaust products remain major problem. This problem can be solved by complex methods such as develeopment of enhanced environmental characteristics of fuel, the development of environmentally friendly vehicles and engines, in particular, the burning of waste gases completely and the uses of additives which provide optimal conditions for combustion of fuels. Calculations have shown that a cost of the reducing harmful wastes of atmosphere estimated as 2200-3100 dollars per day.

The present investigations reveal that the sufficient amount of oxygenated additives in the diesel fuel reduce diesel engine exhaust gases(CO,  $SO_2$ ,  $NO_x$ ), macroparticles, soot emissions and now 1.5 million tons of fuel additives including oxygenated ones are produced in the world. Their production is predicted 10% per year.

Therefore, the content of the exhaust gases of 5% compositions were analyzed which were prepared by mixing ethylene glycol monoesters of cottonseed fatty acids (EGMEsCotFA) and cornseed fatty acids(EGMEsCorFA) and also propylene glycol monoesters of them (PGMEsCotFA, PGMEsCorFA) with first refining diesel distillate (Type-1) and 10% light gasoil of catalytic cracking first refining diesel distillate (Type -2)

Analysis was carried out at the Baku Oil Refinery Plant named after Haydar Aliyev while determining the cetane number with the help of "TESTO 350 TM" probe.

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It is found that combustion of 5% composition was made by addition of monoglycol esters of vegetable oils to the Type -1diesel distillate releases 0,155-0,164% carbon monoxide. It is nearly 3-4 times fewer than that(0,643%) of first refining diesel distillate. Similar results were observed for 5% composition was made addition of mentioned esters to the Type -2 diesel distillate. As it seen from results the amount of carbon monoxide(0,208-0,234%) released by combustion of compositions reduced approximetaly 3,4-3,8% in comparison with the amount of obtained carbon monoxide(0,798%) in the combustion of Type -2 diesel distillate. Besides, analysis of results have shown the amount of carbon monoxide in exhaust gases of the combustion of propylene glycol monoesters added compositions. However, in both cases, no significant changes were observed in the amount of sulfur and nitrogen gases.

In conclusion, monoglycol esters of acids derived from vegetable oils can be used as oxygenated additives to diesel fuels.

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#### PROBLEMS AND PROSPECTS OF CREATION OF BRANCH CLUSTERS IN THE RUSSIAN REGIONS

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In recent years at a mesoeconomic level of national economy such form of economic development as a clustering has a wide circulation. Preconditions to formation of economic clusters are world experience of effective functioning of similar educations; need of integration association of participants of the regional economy having deficiency of various resources; high concentration in the region of the independent, innovative and active and competitive enterprises and the organizations showing a cluster initiative and aspiring to use in the economic activity competitive advantages of the diversified integration which is showing in emergence of synergetic effect, creation of advanced channels business of communications and improvement of the general infrastructure.

The main idea of the concept of a cauterization is creation of integration communications between the manufacturing enterprises, contractors, suppliers of resources and technologies, and also between research and financial credit institutions. Such cooperation and specialization allow participants of a cluster to increase productivity of the activity, to introduce new technologies and products etc. the cluster participating Enterprises more effectively, on the one hand, compete among themselves, and with another – in common solve various problems. Thus, in borders of a cluster the competition, cooperation and integration are peculiar combined.

Comparative advantages of a clustering in comparison with other forms of integration association of participants of regional economy cause dynamism of this process creation

in the Voronezh region of clusters in the sphere of oil and gas and chemical mechanical engineering, electro mechanics, the aircraft manufacturing and radio-electronic industry, and also about five hundred various clusters as a whole across Russia became which consequence. However further formation and development of cluster associations demands improvement of conceptual, methodological and organizational providing. In the created conditions development of reasonable approaches to statement of the purposes and problems of formation and development of research - and - production clusters, determination of potential of a clustering and identification of the enterprises and the organizations, capable to provide structural transformation of specific features of economy of the region in its competitive advantages a way of association to clusters has special value.

Consequences of creation of research-and-production clusters optimum for stakeholders consist in increase in labor productivity and production efficiency increase owing to simplification of access to resources, to information and technologies; stimulation of generation of new knowledge; simplification of commercialization of innovations.

The main advantage of clusters consists in the following: association of subjects of regional economy in research-and-production clusters grows out of evolutionary development of forms of economic interaction of the enterprises and the organizations functioning in administrative borders of a territorial and production complex which achievement is provided under the influence of dialectic laws according to which in a research-and-production cluster there is the cumulative effect which is showing in growth of competitiveness of regional economy at the expense of increase of concentration of the competitive enterprises and the organizations and their transition to new quality.

The specified factors are the basis to believe that association of business units, research and educational institutions, and also other organizations in clusters is the most perfect form of development of regional economy that causes an urgency of a subject of the research devoted to formation and development in the region of research-and-production clusters.

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### ON THE PROBLEM OF ADVANCED TREATMENT OF WASTE GASES ON CLAUS PROCESS AT NON-FERROUS METALLURGICAL PLANTS

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During the latest ten years the whole world is rather worried by the problem of environmental contamination. The population of big cities, industrial centers and the regions with metallurgical plants and electro power stations suffers from atmosphere pollution as well as from soil and surface waters contamination.

The "acid rains" which are falling in some countries have an anthropohenous character. Besides, most of contamination (up to 80% of the whole volume) enters the environment from the burning of different mineral fuels (sulfuric coal, oil and the industrial of its refining) and 20 % from various direct and direct reasons of corrosive violation of constructional steels and memorials of culture made from sandstone and limestone.

There are many ways of extraction the sulfur out of waste gases on Claus installation. More than 80 technologies recommended for use in industrial production have been published. However, just single ones are being used in practice from the great variety of suggested methods. That's why inspite of a great number of advanced purification processes, the elaboration of new technologies is going on.

In the present thesis we observe the question of investigation the content of a gas mixture, obtained both in laboratorial conditions and at the non-ferrous metallurgical plants after a high temperature stage of rehabilitation sulfur dioxide by methane and by two catalytic stages of Claus with the aim of waste gases advanced treatment.

While rehabilitation of sulfur dioxide by the methane the degree of sulfur extraction out of gases at two catalytic stages of Claus is 84-86%. For example, at the initial concentration of SO<sub>2</sub> 20-30% in the gas mixture coming to catalytic stages of Claus the content of gases is nearly (% in volume) H<sub>2</sub>S 3.5-5.5; SO<sub>2</sub> 2.2-3.4; CO 4.5-5.0; H<sub>2</sub> 2.8-3.1; COS 0.8-0.9; CS<sub>2</sub>-traces; CO<sub>2</sub> 16.0-17.0; H<sub>2</sub>O 28.0-29.0; N<sub>2</sub> – the rest.

Further we consider investigating rehabilitation of all sulfuric complexes in hydrogen sulfide as well as oxidation of sulfuric compounds in  $SO_2$  or up to elementary sulfur with its further extraction.

In addition, the improvement of technology on advanced treatment of waste gases is possible at the expense of rising the duration of the used catalysts at the plant and at the expense of searching the new, more effective and cheaper contacts.

V.A. Androkhanov

# PROBLEMS OF RECULTIVATION IN THE NORTH OF SIBERIA

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At the vast area of Siberia the fields of mineral deposits are located at the territory under severe climatic conditions of taiga, tundra and Arctic belts. Development of the northern territories is the result of exploitation of oil and gas fields, construction of roads, gas- and oil pipelines, industrial plots and so on, as well as some other mineral deposits. This fact leads to disturbance of basic components of the environment and very frequently to radical change of soil-forming conditions on such territories. At the same

time, as show not numerous researches, the transformation of natural ecosystems can be of versatile nature. First of all, it is connected with diversity of natural and climatic conditions of the northern territories of Siberia, formation of different types of the disturbed plots and great variety of human impact on natural ecosystems. Therefore, as a result of rather great variety natural and man-made landscapes the different kinds of impact can lead under northern conditions to different consequences.

The influence of man-made objects on natural components can be divided into great groups depending on degree of impact such as 1. Geochemical one i.e. pollution of landscapes by oil, mad wastes, industrial dust etc; 2. Mechanical one, i.e. the destruction of landscape surface as a result of exploitation of deposits, building works and motion of technical equipment etc. At the same time, regardless of type of impact the degree of influence can be divided into three levels: weak, medium and strong. At geochemical influence the level depends on amount of pollutants arrived into landscape. The level of mechanical impact can be estimated by degree of disturbance of soil and soil cover.

Technogenic objects can be located under different conditions of landscape and destroy o significantly change different habitats. At the same time, during construction of technogenic objects the formation of new habitats can take place, which are essentially different from natural ones. In the course of planning and carrying-out of soilrehabilitation works one should take into account the specificity of technogenic object. Under conditions of considerable predominance of cold hydromorphic landscapes it is necessary first of all to consider the specificity of water and temperature regimes as during construction of technogenic objects (both linear and areal ones) considerable changes of these regimes can take place.

Analysis of the situation formed in the region of exploitation of the deposits shows that technogenic effect of industrial and infrastructure objects can be multidirectional. In most cases this influence has negative consequences and degrades natural ecosystems, in other cases despite of disturbance of soil cover the new habitats appear with more favorable environmental conditions than on adjacent territories and such plots one can keep for natural self-healing.

At present time the most complicated situation arises with introduction into practice of modern science intensive technologies of soil rehabilitation. Most of applied ways of soil rehabilitation do not take into account often the specific features of the northern territories and cannot favor to restoration of technogenic objects and reduce essentially negative influence of the disturbed territories on natural ecosystems. The industrial companies give preference to the cheapest and the simplest technologies of restoration with low soil and ecological efficiency. Therefore carrying-out of such technologies cannot cardinally improve ecological situation in the region. The disturbed territories will be practically technogenic for ever and represent an ecological wedge.

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## FUNCTIONAL MATERIALS ON THE BASIS OF FLY ASH MICROSPHERES - A NEW TREND IN UTILIZATION OF COAL-FUELED POWER PLANT WASTE

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Physicochemical properties of components of the ferroaluminosilicate system synthesized using the sol-gel method have been studied in detail as the basis of a large number of modern functional materials including catalysts, adsorbents, porous membranes, magnetic sorbents. At the same time, the properties of this system components, such as ash wastes of power plants formed in high temperature conditions including melting, remain practically unexplored.

The use of microsperical components of ash waste as functional materials, in spite of the obvious practical advantages, also presents serious problems associated with variation of the complex multicomponent composition of the  $Fe_xO_y$ -Al<sub>2</sub>O-<sub>3</sub>SiO<sub>2</sub>-CaO system. For such systems a reasoned conclusion on the functional properties can be made only on the basis of the systematic study of the regularities of a 'composition–structure–property' relationship.

The report presents the results of the study of the general regularities of the relationship between the major component and phase compositions, morphology, structural characteristics of crystalline phases and functional properties of ferrospheres and cenospheres separated from all known types of fly ashes.

For ferrospheres, two composition areas can be allocated that meet the  $F_{e_x}O_y$ - $Al_2O_3$ -SiO\_2 and  $Fe_xO_y$ -CaO systems differed from each other in the character of the relationship of the major component compositions, the morphology of globules, and the microstructure of ferrospinel phase. In both systems, there is a linear correlation between the CaO, SiO\_2,  $Al_2O_3$  contents and the content of iron oxide. An increase in the iron content leads to a monotonic increase in the content of the ferrospinel phase. In this case, the main morphological types of cenospheres change in the following order: porous, glass-like, dendritic, skeleton–dendritic, and block-like.

It was shown that the ferrospheres of the  $Fe_x O_y - Al_2 O_3 - SiO_2$  system are effective catalysts of reactions of deep oxidation of methane, while ferrospheres of the  $Fe_x O_y - CaO$  system effectively conduct the process of the oxidative coupling of methane with the formation of ethane and ethylene.

Non-perforated cenospheres with invariably low iron contents comply with the  $SiO_2$ - $Al_2O_3$  system. The size of the globules, the thickness and porosity of their shell is changing with the increase of the aluminium content. For the first time, it was shown that the coefficient of a helium permeability of microspherical membranes increases by more than three orders of magnitude as the  $Al_2O_3$  content changes in the range from 25 to 30

wt % and linearly increases with the increase of the mullite phase content. This type of microspherical membranes is the promising material for the release of helium from natural gas.

It has been established that the cenospheres narrow fractions with the weight ratio of  $SiO_2/Al_2O_3=1,5-3,4$ , which corresponds to the compositions of zeolites, feldspars, and feldspathoids, can be considered as precursors of mineral-like forms of <sup>137</sup>Cs and <sup>90</sup>Sr radionuclides suitable for their final isolation. The report presents examples of the practical use of microspherical sorbents in the processes of removal and solidification of wastes radionuclides from the enterprises of the State Atomic Energy Corporation "Rosatom" and the United States Department of Energy.

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#### ABOUT ENVIRONMENTAL ASSESSMENT OF SAFIANOVSKIY COPPER MINE ACTIVITIES (SVERDLOVSK OBLAST, RUSSIA)

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Copper mining is one of the main components of Sverdlovsk oblast economy, nowadays and for a long perspective. Therefore, the issues of environmental safety due to copper ores extraction remain very important for the region.

Safianovskiy open pit is the main copper mining enterprise at Middle Ural of Russia. The enterprise has been developing sulfide copper ores of Safianovskiy deposit since 1994. It is located in 95 km to North-East from Yekaterinburg city.

The level of environmental impact of the open pit may be assessed on the basis of quantitative data on atmospheric emission, waste water discharge, production of waste rocks. Specific environmental indicators per 1 ton of ore production over the period of 2006-2011 are shown in the table below (on the data of Ministry of Natural Resources of Sverdlovsk oblast).

Specific indicator per 1 ton	Year						
of ore production	2006	2007	2008	2009	2010	2011	
Ore production, thousand ton	1103	1071	1104	1054	1296	1232	
Atmospheric emissions	0,63	0,64	0,54	0,57	0,43	0,45	
Discharge of waste water	0,17	0,17	0,16	0,18	0,15	0,17	
Waste generation	3,80	4,08	3,84	3,75	3,54	3,24	

As the table shows, there is a decrease over time of specific volumes of emissions by 27% and of waste generation by 21%, as well as almost constant level of specific wastewater discharge. One may conclude that environmental performance of Safianovskiy copper

mine improved slightly from 2006. But, anthropogenic load on natural environment remains sufficiently high in absolute indicators. For instance, 3.99 million ton of waste rocks were placed in dumps and 0.21 million cubic meters of waste water were discharged in 2011.

For getting of objective information about the condition of natural environment, a monitoring system was created and operates on the enterprise. Institute of Industrial Ecology of UB RAS conducts annual explorations of environmental pollution in the influence zone of Safianovskiy copper mine (objects of study: soil, snow cover, water and sediments in rivers, grassy vegetation).

So as a soil is the most objective and stable indicator of man-caused pollution, Institute of Mining of UB RAS develops an original approach for environmental risk assessment concerning soil pollution with toxic elements (mainly - heavy metals).

It is necessary to note that required part of the environmental risk assessment is to assess the damage in monetary terms. The main difficulty here lies in accounting for all components of the damage and also in assessing both the total value of the affected object and its parts, which amounted to losses. The intensity of the anthropogenic impacts and corresponding changes in the environment may be treated as a random process, which determines the degree of environmental and economic risks.

The following components are to be taken into account for ecological risk assessment: the probability of environmental pollution (K1), the possible degree of negative effects in the environment due to the pollution (K2), the level of the natural object's resistance to the pollution (K3). Thus the possible environmental damage in cash (Y) during mineral resources extraction usefully be measured as Y = K1\*K2\*K3\*Cn, where Cn - monetary value of natural objects, subjected to negative influence.

Based on the proposed approach and the environmental monitoring data it is planned to develop a methodology for quantifying of environmental damage due to man-caused impacts, particularly in relation to the mining enterprises influence area.

S.M. Apollonskiy P.V. Korovchenko

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#### ABOUT THE COMPREHENSIVE APPROACH TO DEVELOPMENT OF ENERGY SAVING TECHNOLOGIES

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In the report the thesis is postulated - the output on new level of industrial production is possible only in case of a comprehensive approach to development of all technological chain – from manufacture of a high-quality product, its transfer to a consuming zone, before highly effective consuming. It is impossible to achieve notable effect, without having upgraded all technological chain.

The comprehensive approach to upgrade of electro-energetic branch on the basis of energy saving technologies is analyzed.

The electro-power system (EPS) consists of three main groups of elements: sources of the electric power (EP); power lines of EE and EE receivers on the effectiveness of which depends on the efficiency of EPS as a whole.

Ways to increase the performance coefficient (COP) of EPS are discussed due to:

1. In the production of EE the increase of COP for 10–15% can be achieved by improving at the traditional and alternate methods of use of natural resources (oil, gas, water, a wind, etc.).

2. In case of transmission of EE it is possible to increase efficiency of transmission to 15-20% at the expense of a choice of a method of EE sewerage (on wires or by cable), values of tension of transferred EE and a type of EE (a direct or alternating current).

3. In the case of the EE consumption the increase of COP is possible at 5-10% at the expense of a choice of effective force receivers and to a lesser extent at the expense of a choice of highly effective lighting loading.

Analysis results are given in the report on three groups to EPS elements. In case of implementation of the considered ways of upgrade of EPS elements may increase its efficiency to 30–40%. It is concluded that the increase in efficiency is possible only in case of upgrade of all groups of elements EPS. Real saving in case of upgrade of only one group of EPS elements not to receive. For example, when using as luminous loading of luminescent lamps or LEDs with essentially big efficiency, than at glow lamps. Such approach to energy saving will lead to under-load of sources of EE, their operation with the under efficiency, to increase in consuming of natural resources (oil, gas, etc.) and to lowering of the general efficiency of EPS.

Probably, a certain effect can be received when using sources of EE of small capacity (capacity in some hundred kW), including alternate sources of EE, such as: the tidal power stations, wind power stations, geothermal stations, solar power stations, pumping stations and stations on biological fuel. However, in case of the modern level of their production will require the considerable capital expenditure which can be paid only for a long time. Besides, they will demand radical reorganization of EPS, its regulating and controlling subsystems.

In the report it is marked: it is necessary to consider environmental problems of influence of the accepted decisions on the person in case of end-to-end solution of the task about increase in efficiency of EPS.

S.M. Apollonskiy

# PRINCIPLES OF ESTIMATED PREDICTION OF AN ELECTROMAGNETIC FIELD OF NEAR RADIATING OBJECTS

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In the report methodological principles of estimated prediction of an electromagnetic field (EMF) near radiating sources are discussed. It should be carried out on blueprint

stages, constructions or reconstruction of radiating objects. It will allow to evaluate the electromagnetic environment from the point of view of execution of operating standards, to plan a complex of actions of organizational and town-planning character. Besides, the correct prediction evaluates perspectives of development of objects of telecommunications and justifies a resource of an energy potential of technical means of radiating sources. Electromagnetic prediction for the purposes of electromagnetic compatibility (EMC) of technical means and bio-objects is defined by broad range of approaches and characteristics.

It is necessary to provide the complex research of a problem taking into account all major correlations in case of the solution of problems for means of a radio communication, broadcasting and television. It is not difficult to trace these correlations on separate EMC problems. So, for example, rating, measurement and protection against EMF of technical means can be carried out only together with the analysis of structure of this field in an interaction zone with biological objects. In turn, rating defines need and a protection level, and also requirements to metering equipment. The analysis of structure of fields is possible by a combination of theoretical and experimental research methods.

Estimated prediction is very complex task. Always there is a question of accuracy of calculations of EMF which is defined by a detailing level, both radiating elements, and environment. EMF prediction near radiating objects can be executed by three different methods: analytical and physical modeling, analogies and extrapolation, heuristic prediction.

The assessment is given to the considered prediction methods. Obviously, the electromagnetic predictions must be studied by trained professionals who are familiar with the theory of electromagnetic fields, electrodynamics, propagation, systemic issues of telecommunications, etc. In this case methods of calculation of EMF in environment can be rather difficult, and, therefore, and more exact. Formalization of process of electromagnetic prediction though is possible, but requires use of high-performance computing and big financial expenses.

Practice of design of difficult systems in case of whom the developer operates with approximate mathematical models of objects, leads to large volume of the pilot studies and to impossibility at a design stage to consider all diversity of object properties. The solution of a question - a failure from "rough" models and use of the algorithms based on real boundary value problems for Maxwell's equations. Along with the high level of adequacy such mathematical models are universal, that is are suitable for many objects. Currently not simplified electro-dynamic models make a basis of automated design engineering systems of scanners and systems of telecommunications.

S.M. Apollonskiy

#### IMPACT ASSESSMENT OF METAL STRUCTURES ON THE ELECTROMAGNETIC AIR ENVIRONMENT OF THE URBANIZED SPACE

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In urbanized airspace due to the large number of sources of electromagnetic fields (EMF) is generated electromagnetic environment of a wide frequency spectrum. Low frequency electromagnetic fields is generated by power lines, electrical units, electric transport and other sources. EMF of high frequency is created with mobile phones. These include: wireless phone (frequency 814-815 MHz, 904-905 MHz and 450-1800 MHz with different modulation types (11, 50 and 270 Hz)), cellular communication (frequencies from 400 MHz to 2000 MHz), etc. (including paging communication, trunk communications, mobile satellite communication).

The report examines the impact of metallic structures, such as roofing iron, by which are covered most of the roofs of industrial and domestic urban buildings, on the electromagnetic air environment of the urbanized space. Availability of roofing iron leads to a spatial redistribution of the intensities of EMF in the air, and its frequency range. In an air environment, along with the first spatial and temporal harmonics caused by sources of EMF, there are a range inter-harmonics because of statistically uneven surface of roofs and the non-uniform electro-physical parameters of roofing iron.

If we consider a field uniform or as an elementary source (electric or magnetic dipole), the diffraction of the field on the metal roof, limited by a coordinate surface leads to the appearance in the air environment of a set of spatial harmonics with integer indices.

However, we are dealing in the urbanized area immediately with a set of n source and m metal roofs. In this case, EMF is considerably more complicated. As show the calculations, which have been carried out on the model problems, in addition to the spatial harmonics with integer indices, there are harmonics with fractional indices. The range of spatial harmonics essentially extends.

The intensity of the reflected signals and their frequency range depends on the ratio of the linear dimensions L of the reflecting surface, the length and shape of the sources of electromagnetic waves. The form of roofing iron, usually does not coincide with the coordinate surface. Frequency spectrum depends on the spatial correlation radii of the surface slope. If  $l_{min}$ ,  $l_{max}$  - maximum and minimum radii of the correlation slope of the roof, then:

a) If  $L >> l_{max}$  - the width of the fluctuation spectrum of the reflected signal is independent of the statistical parameters of the roof, and is determined only by the speed of an electromagnetic wave, beam width and pulse duration.

b) If  $L << l_{min}$  - the fluctuations in the intensity of the reflected signal are due to

parameters roof, and the energy spectrum of the fluctuations of the reflected signal has a wider range of frequencies than the incident signal. The frequency range of the reflected signal towards higher frequencies extends.

In winter, the roofs are covered with ice, which, in turn, makes adjustments in the distribution of electromagnetic field strengths in the air: there is an anomaly of the electromagnetic properties of ice, there are special electromagnetic properties associated with the manifestation of the spatial dispersion of the dielectric constant.

The report analyzes various cases EMF dispersion and its impact on communications.

S.M. Apollonskiy	ELECTROMAGNETIC SAFETY OF PERSONS INDOORS						
P.V. Korovchenko							

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Electromagnetic indoor environment is formed as external and internal sources. Among external sources which are essentially influencing the person in the housing, it is necessary to call: man-made electromagnetic fields (EMF) from power sources, electric and magnetic fields (EF and MF) Earth EMF from telluric currents, geopathic zones and various types of radiation. Among the man-made sources of EMF it is necessary to identify: power lines (air, cable), transformers, distribution switchboards and other electrical devices.

In case of simultaneous action of several man-made sources of EMF magnetic induction indoors is likely to increase up to 2  $\mu T$  and above. It greatly exceeds the natural electromagnetic background of this territory and the changes during the day due to changes in consumption.

Among internal sources it is necessary to identify: various Power supply and currents in structures, household appliances, lighting equipment. Particular attention should be paid to the EMF from the currents in the building structures. They can influence the increase of electromagnetic fields indoors and, in addition, create currents that are dangerous for human life. According to recent studies the empirical formula to determine the boundary current, dangerous to human life, can be represented as

$$I = \frac{165}{\sqrt{t}} \cdot 10^{-3}$$
 , A

where I - the maximum value of the current, t - time effects, c.

The report discusses issues oversaturated of domestic premises and lighting devices. Because of the uncontrolled use of many powerful electrical devices intensity EMF can reach values well above the maximum permissible levels (MPL), the recommended regulations ICNIRP, IRPA, CENELEC, etc.

The report notes, that in hygiene of living conditions the concept of "risk" and security

habitat is insufficiently developed. The results of researches carried out by experts in the field of electromagnetic safety, showed that at the combined effects of electromagnetic fields on the person intensity MPL of each factor should be significantly reduced compared with the single-factor MPL.

Trend analysis of the means and processes of hygienic permit conclusions:

- Science-based regulation of radiation facilities (including cell phones) will not be made ever since the rate of development of technical solutions significantly outperforms traditional valuation;

- Existing single-factor hygiene criteria don't correspond to the valid dangerous biological impacts on the real conditions of human multi-factorial natural and man-made influences;

- Existing indicators hygienic standards do not reflect a unified approach to the description of the functional diversity of the sources of man-made electromagnetic fields on the person: low-frequency, high-frequency, pulse, single, continuous, modulated, etc.

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## EVALUATION OF SOIL PHYTOTOXICITY IN SARATOV

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Currently, soils in urban areas have are in catastrophic conditions. Within the city limits of Saratov, two major groups of soils occur: relics of natural soils and urban soils. The first group includes six types of natural soils at the relic sites: grey forest soils common chernozems, southern chernozems, floodplain alluvial soils, meadow-chernozems, meadow-kastanozens and solonetz soils. All these soil types have relatively weak leaching regime and ability to accumulate pollutants.

Phytotesting as a method of soil evaluation has been long used to determine seed quality and soil fertility of farmlands. Since recently, the method is used in ecology for assessment of environmental quality. The laboratory methods of phytotesting are particularly relevant for environmental control because they are fast and cheap.

The objective of this study was assessment of soil toxicity in Saratov using plant test objects. Therefore, our study objects were soil samples collected during May and June of 2010 and 2011 in Saratov in areas of the highest anthropogenic impact, such as: along the roadways, at the intersections of major highways, in the vicinity of industrial enterprises, and in the older and newer residential areas. Soils collected three km off the city limits served as control samples. We evaluated the toxicity of soil samples and of water extracts from soils using plants: Triticum durum Desf. (the variety "Favorite") and Raphanus sativus L. (the variety "Red With a White Tip"). Employed methods complied with the Federal Standard R ISO 22030-2009.

Our study discovered that in most cases water extracts gave lower results of soil toxicity

compared with those obtained from soil samples. This could be explained by the fact that the aqueous extract includes only water-soluble compounds.

Phytotoxicity assessment of soils in Saratov using R. sativus as a test object showed that the germination rates of radish seeds in soil samples and in water extracts from soils were not significantly different from the control. Slight suppression of growth was observed only in samples collected near highways. Collected data did not show the toxicity of all analyzed soil samples. Evaluation of morphometric and physiological parameters in the test object R. sativus revealed decreased weights of the sprouts grown in soils collected near roads and in residential areas.

Assessment of soil toxicity from germination of bioassay test-object T. durum showed that soil samples collected near industrial areas and along the highways had moderate toxicity. Soil samples collected near downtown city streets and residential areas were lightly toxic. Our study of morphometric traits of the test object grown in soils collected in Saratov found deviations in the root and stem lengths in samples obtained at the intersections of Saratov highways, near industrial areas, and on the waterfront. We discovered statistically significant differences in stem lengths of the test objects grown in urban versus control soils.

Evaluation of soil extract toxicity from germination of T. durum showed high toxicity of samples collected near the industrial areas and along the city waterfront. Moderate toxicity was established for samples taken near highways. Water extracts from soils in residential areas had low toxicity. As for morphometric traits, we found deviations from control values in both stem and root lengths of plants grown soils taken near industrial areas, at the waterfront, and near intersections of major highways. In samples taken at other locations, we did not find significant deviations from control values.

Comparison of test results using two test objects showed that T. durum was more sensitive than R. sativus in assessing urban soil quality. This may be associated with physiological and morphological traits of the test plants, and also with specificity of the pollutants in soil samples.

To compare toxicity of urban soils with background toxicity levels, we computed the toxicity index of evaluated factor (TIEF) sensu R. Kabirov. Using TIEF enabled us to integrate the relative values of various indices, absolute values of which could not be combined into a single index because they had different units of measurement.

Integral toxicity assessment of soil samples and mapping of soil phytotoxicity in Saratov has identified three areas in the city corresponding to the background toxicity levels as well as low and moderate phytotoxicity. The area of moderate toxicity linearly extended along the coastline of the Volgograd Reservoir. This area includes industrial enterprises and the highway connecting different parts of the city.

Thus, using plant test-objects with varying degrees of sensitivity to environmental toxicants, and employing various test criteria for bioassay enabled us to characterize the toxicity of soils in Saratov and to assess the levels of anthropogenic pressure.

Yu.I. Bauman A.S. Lysakova A.V. Rudnev I.V. Mishakov A.A. Vedyagin Yu.V. Shubin

## MODEL NI-M (M = CO, CU, CR) ALLOYED CATALYSTS FOR UTILIZATION OF MULTI-CHLORINATED HYDROCARBONS

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Accumulation of organochlorine wastes is one of the toughest problem in Russian Federation where thousand tons of chlorinated hydrocarbons are annually produced as commercial industrial product. Chlorinated hydrocarbons (ClHCs) exhibit high toxicity and form a class of undesirable compounds that are produced by a wide range of industrial processes as by-products. Most of polychlorinated HCs are known to be environmentally persistent chemicals which accumulate in tissues and show carcinogenic and mutagenic activity.

We have proposed a new approach to recycling the multi-chlorinated HC-waste based on their catalytic decomposition by carbide cycle mechanism to form carbon nanofibers (CNF). Bulk Ni-containing alloys are used as a novel precursor for catalysts prepared in situ under action of reaction gas feed. It was recently found that the catalysts obtained from a commercial Ni-Cr alloy show high CNF yield (over 500 g/g<sub>Ni</sub>) and resistance to deactivation in aggressive media.

A new series of model Ni-M (M = Co, Cu, Cr) alloys containing a various concentration of M (0.5-50 mol.%) have been prepared by coprecipitation method followed by controlled reduction of mixed hydroxides (carbonates) in hydrogen. The real composition of obtained Ni-M alloys was identified by XRD studies. The catalytic activity of synthesized Ni-Co, Ni-Cu and Ni-Cr samples was examined in decomposition of  $H_2/Ar/C_2H_4Cl_2$  mix at 600°C in gravimetric bed flow reactor. The effect of M and its concentration on kinetics and peculiarities of texture and morphology of produced carbon nanofibers will be discussed in the report.



Fig.1. SEM images of fragmented carbon nanofibers obtained via decomposition of 1,2-

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#### dichloroethane on model alloys: Ni-Co (a), Ni-Cu (b), Ni-Cr (c).

In order to make a step towards the development of recycling technology we have created a demonstration setup to test the catalysts at scale-up regime. Preliminary tests on Ni-Cr bulk alloys showed specific productivity of reactor at level of about 70 g(CNF)/g(cat)\*hour, with the selectivity towards carbon more than 60%. The resulting CNFs are characterized by high surface area (up to 400 m<sup>2</sup>/g) and unique segmented structure (Fig.1), which allows one to consider such product as promising modifying additive in composition of cement stone and lubricants.

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V.L.Belyaev A.A. Shalaginov

# HIGH-CURRENT CONTACT SYSTEMS USING ELECTRICALLY CONDUCTIVE LUBRICANTS

National Mining University, Saint Petersburg

The works is dedicated to study of high-current contact systems (HCCS) of electrolysis enterprises of chemical and metallurgical industries.

The goal of the present work is the study of contact transitions of heterogeneous contact materials using modern electrically conductive lubricants EPS-90, EPS-150, EPS-200, EPS-300+, EPS-SK, the measurement of decrease of voltage and temperature of heating the contact transitions of different contact connections on the experimental plant not using or using the electrically conductive lubricants, using different amount of bolted connections, different types of welded connections and so on.

Electrically conductive lubricants (ECL) represent the compositions of some lubricating materials with electrically conductive powder fillings.

EPL are purposed for lowering and stabilization of contact resistance in any metallic bolted contact connections of power, lighting equipment, communication systems and essential energy saving.

The advantages of ECL are as follows: lowering of contact resistance, stabilization of contact resistance; increase of operating reliability of electrical equipment; increase of operation time of electrical equipment; energy saving at the industrial enterprise; fire-safe coating of metal contacts; anticorrosion coating of metal contacts.

When using ECL the current distribution in parallel branches of HCCS becomes more homogeneous, the contact resistance lowers depending on condition and materials of contact surfaces, and its stability over time increases. Besides, sealing and reliability of HCCS to the sealing characteristic of ECL and increase of their thermal and electrical stability are increasing. The latter is caused by the following: sufficient fluidity of composition provides for its extrusion in the contacting zone; introduction of metallic electrically conductive powder with small-sized particles into the neutral lubricant leads

to filling up of micro-cavities of the touching contact surfaces and increase of contact area (in spite of the higher specific resistance of ECL, then of main conductors of materials – copper, aluminum), as well as to approximation of values of expansion coefficients of contact materials and the lubricant.

When using ECL it is not necessary to use other scarce and expensive stabilization means of contact resistance: copper-aluminum transition parts, plate springs, metal coats of contacting surfaces and so on.

Several kinds of contact transitions were studied: copper-copper, copper- aluminum, aluminum - aluminum, copper- copper-clad aluminum, aluminum - copper-clad aluminum and so on. All buses were of size: 54 x 10 x 147. Nominal current rating is 600 Amp.

The object of study were 5 types of modern electrically conductive lubricants EPS-90, EPS-150, EPS-200, EPS-300+, EPS-SK, that were applied on the preliminary protected contact surfaces of buses, and the bolts tightened using the instant indicator key type DK-25 in accordance with GOST 10434-82. So, the value of torsion torque at tightening bolt M12 should correspond to 60-70 Nm; M16 – 90 – 100 Nm; M20 – 120 – 130 Nm; M24 – 200 – 220 Nm; M30 – 300 – 340 Nm; M36 – 360 – 380 Nm;

The millivoltmeter was used to study the values of voltage drop, and the digital, laboratory thermometer was used to define values of heating temperatures. This data were read from the studied contact connections during several months and were recorded in the test protocols.

Based on the obtained data the graphical curves of contact resistance and heating temperatures from the time were drawn, showing that contact connections where ECL was used are favorably compared with contact connections without ECL, which in conditions of manufacturing will lead to significant decrease of consumed capacity and economy of electric energy. So, 1 kg of electrically conductive lubricant during 1 year saves the electric energy at general purpose industrial enterprises up to 10 000 kW, at energy-consuming enterprises – up to 100 000 kw-hrs.

The laboratory tests of ECL development prototypes showed, that they are simple to mount and service, reliable at operation, have minimal contact resistances and electrical energy losses and longer service life in comparison with the contact connections without using the electrically conductive lubricants.

V.L. Belyaev A.A. Shalaginov

#### **MODERN HEAVY-CURRENT SHUNTING BREAKERS**

. National Mining University, Saint Petersburg

Nowadays, the design of heavy-current electrical apparatuses is especially actual for their usage in power-consuming industries, for example, in electrolysis plants of enterprises of chemical and metallurgy industry, where current flows through in-series electrolyzers, and current is measured in dozens and hundreds thousands amperes with a voltage of 400-500V. Heavy-current shunting breakers (HSB), connected in parallel to electrolyzers, are used for the purpose of periodic examination and repair of each electrolyzer without interrupting the operation of the rest. In case of HSB contact closure, load current flows directly through it, while the eletrolyzer, in these circumstances, can be shut off.

At present, series-produced HSB of B-61 type for load current of 63 kA completely dissatisfies customers in consequence of using of hard-to-find and expensive silver, very limited operational resource during the interrepair period — not more than 20–30 switch on/ switch off (ON – OFF) operations, unreliability of flexible copper joints, complexity of breaker's repair in the conditions of active manufacture and the increase of rated current of electrolysis devices.

It is known, that electrolysis devices are already operated on load current of 100 kA. New types of electrolyzers are being designed for load current of 150 kA and 250 kA. Therefore, demand for using of HSB significantly increases, moreover, there is a necessity to change silver contacts to composition and liquid-metal contacts (CLMC) on the basis of gallium and it's alloys.

Different modifications of HSB and CLMC for various load currents and with natural and water cooling were designed, as a result of long-term researches and engineer developments, manufacture and test of prototype model of HSB by orders from chemical industry plants.

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Type of device Engineer factors	VSh-400 CLMC	ShaG-500 CLMC	V-61 CLMC	V-75 CLMC	
Rated current, kA	40	50	65	75(100)	
Rated voltage, V	100	100	100	100	
Rated voltage to ground, V	400	400	400	400	
Main contact materials	Composition	Composition	Composition (in nitric area)	Composition (in nitric area)	
Cooling (cooling water flow, l/h)	Natural air	Flowing water (750)	Flowing water (1000)	Flowing water (1500)	
Device drive	Manual (pneumatic)	Manual (pneumatic)	Manual (pneumatic)	Manual (pneumatic)	
Number of commutations during interrepair time	100	100	100	100	
Sizes, dimensions, mm	780x758x700	-	621x480x815	621x480x815	
Weight, kg	400	-	230	300	

Specifications of several types of designed HSB are listed in the Table 1.

Production testing of prototype samples of HSS showed that they are simple in assembly and maintenance, reliable during operation, obtain little power consumption and long service life in comparison with series-produced breaker V-61.

#### A.A. Belyachenko

### USING GIS-TECHNOLOGIES FOR MONITORING OF TREE CONDITION IN SUBURBAN FOREST SYNFOLIUMS OF SARATOV REGION

Saratov State Technical University named after Yu.A. Gagarin, Saratov

Recently a number of unfavorable ecological factors result in considerable changes of forest phytocenosis. These changes affect every synfolium and frequently damage trees. Consequently it affects transformation training in synfoliums. As a result of increasing recreation load on the suburban forests it has become urgent to evaluate the impact of natural and anthropogenic ecological factors on the synfolium conditions.

To reveal the influence of recreational forest use on tree conditions certain parameters of forest vegetation have been measured on the territory of several large suburban forests in Saratov region. Moreover the relief influence was estimated as one of the main factors affecting both phytocenosis distribution in suburban forests and intensity of recreational land use (Boldyrev, Stepanov, 2000; Boldyrev, 2005). The research was conducted on the territory of "Kumysnaya Polyana" natural park in the outskirts of Saratov from May to June 2010. Complete geobotanical descriptions of forest vegetation were given on the trial plots and life condition of trees was evaluated (Yunnatov, 1964; Voronov, 1973; Alexeev, 1989; Matveev, 2006). Different characteristics of trees' condition on the territory of "Kumysnaya Polyana" Natural Park are shown in the tables.

Species	Slope ex- position	Trees' condition					
		Ι	II	III	IV	Va	V <sub>b</sub>
Qercus robur L.	N	1/0/0*	62/55/52	28/30/29	9/13/15	0/1/2	0/1/2
	S	4/3/1	60/56/53	30/31/35	6/8/10	0/2/1	-
	W	9/4/2	59/67/61	29/25/30	3/4/7	-	-
	E	0/1/0	48/49/53	30/32/27	22/17/17	0/1/1	0/0/1
Acer plata- noides L.	N	97/91/88	3/9/12	-	-	-	-
	S	99/95/94	1/5/6	-	-	-	-
	W	96/95/95	4/5/5	-	-	-	-
	E	90/88/84	10/12/16	-	-	-	-
Tilia cordata Mill.	N	2/0/0	58/59/55	16/15/16	23/24/26	1/2/3	-
	S	7/5/2	70/72/74	23/23/24	-	-	-
	W	5/3/2	65/73/73	30/24/25	-	-	-
	E	2/1/0	65/61/59	16/15/17	17/22/22	0/1/2	-

Table – Trees' condition on the territory of "Kumysnaya Polyana" Natural Park

Populustrem-	Ν	3/3/0	71/63/63	18/22/21	8/10/13	0/2/3	
	S	14/10/3	70/67/73	16/20/22	0/3/2	-	-
ula L.	W	17/6/3	73/74/73	10/20/24	-	-	-
	E	2/3/0	54/55/57	23/21/22	21/21/21	-	-

\*Percent of trees of different condition observed in upper (first number), middle (second number) and lower (third number) areas of slopes are given in the table.

On the whole the best condition is typical for Norway maple on the territory of "Kumysnaya Polyana" Natural Park. Most of the oak trees are in weakened or highly bad conditions. Maximum of sound and weakened trees as well as minimum of highly weakened trees were observed in upper and middle areas of slopes in northern and western expositions. On the contrary the worst life condition is characteristic for oaks in the middle and lower areas of slopes in the southern expositions. Tillet and aspen are mostly in weakened life condition. Besides some trees of these species are in drying condition or in condition of fresh dead-wood. The best condition of tillet was observed in the middle slope areas in the north and east; the worst condition was revealed in the south and west. It is connected with the fact that the maximum number of campers is distributed near upper slopes of gully-hollow systems and at the bottom parts, whereas steep middle parts of slopes are hardly ever visited. Moreover forestry measures are seldom taken here. Thus the research results show that the most important factors influencing the forest phytocenosis are the relief and recreational load on the territory in the suburban forests of Saratov region. The most favorable conditions for forest phytocenosis are the middle slope areas of northern exposition, the least favorable are the lower areas of southern slopes. The life condition of trees gets better with the decrease in recreational load on the territory.

S.E. Berezin

#### SELECTION OF THE TYPE OF THE AIR SUPPLY CONTROL FOR MUNICIPAL AND INDUSTRIAL AERATION

SJSC "WWW", Moscow

The control of air supply is a cost effective method both for energy saving and return on investment.

The demand for airflow regulation contributed to the creation and improvement of equipment for air supply in a controlled mode.

Among the methods used to control the air blower equipment - direct throttle at the inlet of the blower, the variable frequency of shaft rotation, changing the incidence angle of the inlet flow - the latter is the optimal method for the aeration system.

The constancy of head (pressure) value, inherent to Q-H characteristics of the air pipe and air blower, controlled by turning blades, causes a significant advantage of this equipment as for energy efficiency.

The double air flow control method at the inlet/outlet of the turbomachine provides the flow regulation in the range from 100 to 40% and ensures more efficiency than competitors do. Cover of expenditure counts only a few years.

Yu.I. Bezrukov A.A. Shalaginov

#### "DISCOLET" – A PERSPECTIVE AVIATION TRANSPORT

CJSC "DISCOLET", Arsenyev, Primorsky region

: CJSC "Research Institute for Marine Systems", Saint Petersburg

The goal of this work is to create the personal aviation transport, mainly, of vertical (super-short) take-off and landing of the General aviation (GA) by uniting and cooperation of international scientific societies and business circles.

The international experience shows, that GA plays the important part in the economics of the developed countries. For example, in the USA over 190 000 GA airplanes are used, and only as taxes it provides over 1 billion dollars for the budget of the country.

At the same time, in the aviation there is a niche formed between helicopters (vertical take-off, but low speed and flight distance with high fuel consumption) and airplanes (high speed and distance, but the airfields, usually extramural, are needed).

This niche could be filled by discolets, that combine the airplane speed and flight distance with vertical (super-short) take-off and landing on the unprepared sites and basing without the airfield.

Main features of "DISCOLET":

• Integral aerodynamic arrangement includes the flying wing with the following parts embedded: cockpit, lift-propulsion systems with changeable traction vector, navigation and altitude equipment, as well as all necessary devices for safe take-off, flight and landing on the unprepared sites;

• High reliability. The complete surface of the discolet is a lifting wing with very small load, total 20-30 daN/m ; Two mutually interchangeable thrusters;

• Good performance characteristics. The flight speed of a discolet exceeds the helicopter speed by 2-3 times. Possibility of hovering in the air. Carrying capacity on the move or during take-off as an airplane is higher than the carrying capacity of a helicopter. Low-level noise;

• Cost effectiveness. Discolet is more efficient than a helicopter by 4-5 times;

• Safety. In case of capture by terrorists or other gross violation of "Rules" the manual control is switched off and the discolet in the automatic mode or in the mode of ground control is landed on the site of the nearest police department.

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Scope of possible application of discolets:

• Complex issues of the emergency medical services and rescue operations;

- Transportation of people and cargoes "from porch to porch";
- Map-making aerial photography.

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• Communication - mail delivery, checking communication lines.

• Patrolling the electric communication lines, railway and automobile roads, gas and oil pipelines, woodlands, spawning streams, vital points.

• Patrolling the state borders, antiterrorist protection.

Creation and manufacture of the proposed discolets can be organized on the aviation enterprises of EU, where the large number of aeronautical specialists are being fired, that could manufacture over 20 000 discolets per year, with net income over 300 mln. EUR annually.

T.L. Bezrukova V.M. Bugakov I.S. Zinovyeva

# CONCEPT OF SUSTAINABLE DEVELOPMENT OF NATURE

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Short abstract: The paper devoted to studying of problems of sustainable development of nature management. Highlights are the limitations of the terrestrial biosphere and the need to follow a new model of sustainable development, taking into account the principle of rational and inexhaustible management of natural resources

Key words: nature management, sustainable development, nature and resource potential, environmental policy

Recent studies have shown that the Earth's biosphere as a whole and its separate components (ecosystems at different levels) have limited capacity to ensure its proper functioning and reproduction in conditions of excessive human impacts. In this regard, a number of global problems whose solution almost is not seen in the current models of development, an important place is occupied by problems such as the depletion of the available natural resources and pollution of the Earth's natural environment of the planet, in fact - the habitat of people and all life on Earth .

The concept of sustainable development was formed in the course of gradual public awareness of the environmental, economic and social issues that have an impact on the natural environment. This is the reverse reaction of society to the observed and widely reported by the broad scientific publications and media processes of degradation of nature under heavy anthropogenic influence.

Development of strategies for sustainable development contributes to the creation of new approaches to environmental policy. These include strategic environmental assessment, which emphasizes identification of cumulative impacts of economic activity and the impact of government plans and decisions in various areas of social and economic development on the environment, the development of indicators of sustainable development, the creation of nature-oriented companies and enterprise management systems, the implementation of an integrated control of pollution of the environment (including the development of appropriate legislation) simultaneously in different media by companies throughout

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their life cycle to the point of waste; development of registers of emissions, discharges and transfers of pollutants, expanding "trade" by permissions on unused emissions to air and water, the issue of securities, voluntary agreements between industrial companies or associations with the government on assumption of voluntary commitments about taking care of environment, not waiting for decisions or legislation, joint conservation measures of countries at different levels of development (for example, by investments from countries- "financial donors"), the implementation of integrated environmental and economic accounting based on the system of National Accounts, approved by the UN, etc.

Thus, humanity has taken a new development model. That is, the transition to sustainable development on a global scale is strictly necessary: there is no reasonable and justifiable alternative to it. Mankind as a species will survive only if he can establish such a balance between its vital functions and capabilities of the biosphere, which would not only preserve the living world, but would always allow to reproduce renewable resources of the planet and ensure the rational use of nonrenewable resources to at least as long as the humanity will not open in front of it new reserves of energy, raw materials and food resources of the oceans and outer space. But at the regional and national level, this means that two of the initial dimensions of sustainable development - environmental and economic - are inferior to transfer the concept of sustainable development into practice: they must be complemented by the other aspects: social, information, management, etc.

T.V. Bobra A.I. Lychak

### ANALYSIS OF WATER QUALITY AND ITS IMPACT ON THE HEALTH OF THE POPULATION OF THE AUTONOMOUS REPUBLIC OF CRIMEA

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The main legislative act regulating the water use, water protection, public administration and control of water use and protection, reconstruction of water resources is the Water Code of Ukraine (1995). The environmental monitoring systems are the main departmental network monitoring the quality of water, fully covering the territory of the Autonomous Republic of Crimea: Republican Sanitary-Epidemiological Station (SES), Republican Committee of the Autonomous Republic Of Crimea for the environmental protection, Crimean Republic Hydrometeorological Centre, Republican Water Committee of Crimea.

The analysis of the structure and the modes of observation systems of departmental environmental monitoring in Crimea has shown, that interagency cooperation is not sufficient for the effective environmental management in general and the water resources in particular. The agencies share primary data as a rule only in the exceptional cases. This is due either to the need to provide some data for the development of regulatory and licensing documents (eg, maximum allowable emissions, discharges, etc.), or due to the emergency situations of technogenic and ecological character.

The main weaknesses identified in the monitoring of water resources and the environment are the following: 1) the discrepancy between the spatial mismatch of the system (a small number of the monitoring points), the regimes and the number of modes and parameters for gathering information on the status of the water resources and the European water monitoring systems; 2) large differences in the methods and formats of collecting data and reporting environmental information with the EU countries; 3) the prevalence in the organization of the monitoring systems of departmental approach over the territorial one, which results in the low efficiency of interaction of the departments between themselves and with the executive power bodies; 4) lack of automation and use of modern information technologies (databases, GIS, digital maps, etc.) in collecting and processing the data, which does not allow to take quickly the necessary management decisions; 5) reducing of the level of financial and logistical support, leading to a decrease in the volume of carried out observations, dropping the quality and effectiveness of space-time observation networks.

There are 1657 rivers, streams and ravines on the territory of Crimea with the total length of 5996 km. In the water balance of Crimea the contribution of the river water reservoirs, taking into account the reservoirs of natural flow makes 9.5% (2012). The average river network density for the whole territory of Crimea is 0.22 km/km<sup>2</sup>. There are 1708 ponds, 23 major reservoirs in the ARC. For July 18, 2011, the reserves of water in the reservoirs of the natural flow, intended for the drinking water supply, comprised/were 12093.972 million m<sup>3</sup>, water storage in off-channel water reservoirs - 99.606 million m<sup>3</sup>.

The monitoring of the quality of water in the artificial reservoirs, canals and ponds is exercised by the Committee on water resources development and irrigated agriculture of the ARC and Crimean State reclamation expedition. Each water sample is determined from 28 to 53 water quality parameters.

The analysis of the data for the period 2006-2010 showed that most often in the waters of man-made artificial reservoirs, canals and ponds (in accordance with the regulatory requirements of SanRaN No. 4630-88 "Sanitary rules and norms of surface waters protection from pollution" (for bodies of drinking water) the maximum permissible concentration of such indicators are observed: chemical oxygen demand (COD); five-day biochemical oxygen demand (BOD 5); pH (pH); content of aluminum and manganese.

The Ukrainian legislation on health is based on the Constitution of Ukraine and consists from the Law of Ukraine "The basics of Ukrainian legislation on health care" (Vedomosty of Supreme Council, 1993, N 4, Article 19) and the other legislative acts adopted in accordance with it, regulating the social relations in health care (http://www.moz.gov.ua). Regulatory and policy documents of the Ministry of Health of Ukraine are located on the site http://www.mozdocs.kiev.ua.
The current situation in Ukraine and Crimea, the organizational structure of the collection, processing and analyzing the information on health status and the factors affecting it includes the regional offices of the Ministry of Health, Statistics, Environment and Natural Resources of Ukraine.

The main sources of information for studying the health status of the population in Crimea are:

- The data of the network of medical institutions (see section 3.3), providing the system of medical statistics and carrying out the operational monitoring of the health status of the residents of the region. Currently there are 759 medical institutions of various fields (for 01.07.2011) in the Autonomous Republic of Crimea;

- The materials of the State Sanitary and Epidemiological Service, which conducts the monitoring of sanitary and hygienic situation in places of public accommodation (Republican, 23 city and district stations, 4 port sanitary-epidemiological stations);

- The data of scientific and practical institutions receiving information about the individual settings, the health status and the factors affecting it (Center for Maternal and Child Health - primary data base on the complications of pregnancy, perinatal mortality; Anti-Plague Station - monitoring of particularly dangerous infections in the natural foci of their occurrence and others).

The current situation in Ukraine, the system of collecting data on the health status and the quality of these data do not meet the requirements of time and the practical possibilities of modern information technology. The methodological framework and the approaches to treatment and providing information on health over the past 30 years have changed many times and, therefore, are focused on identifying the short-term trends (2-3 years). This limits the possibilities of analysis and reduces it to the detection of the quantitative differences without the characteristics of the long-term changes and their causes. The comparative analysis of changes in the health status at the level of the administrativeterritorial units of the Autonomous Republic of Crimea is practically non-existent. The individual scientific-research projects can not fill this gap.

Technically, the processing and analysis of the material are difficult due to the fact that the health statistics are kept mostly on paper, are dispersed in the documents of the various reporting agencies. This often gives rise to the contradictory statistics, complicates their analysis and synthesis. These figures are available to the wide range of specialists, as a rule, only in the generalized form of large territorial units, and in the form of the average parameters for a year.

The weak point in solving of the problem of the quantitative assessment of the population health is the insufficient use of modern information technologies, which would allow to coordinate quickly the information flows and to analyze them. It is necessary to move in this direction towards the creation of the databases on the basis of the digital maps, where different kinds of the information would have the spatial and temporal binding. The maps of this kind are the basis for the simulation models that allow to identify the most relevant for the health in the region factors, and as a result to make the most reasoned

management decisions.

To analyze the morbidity and the sickness rate of the ARC population the data from the state health statistics provided by the General Directorate of Statistics in the ARC were used, which is one of the subjects of monitoring the health of the population of Crimea and the Crimean Republic institution "The Information-analytical center" of the Ministry of Health of the ARC. The statistical data are provided on the basis of the regulation, approved by the Order of the Ministry of Health of Ukraine from 30.06.98 No. 180.

The bulk of the Crimean population is concentrated in six main city councils of Crimea: Sevastopol, Simferopol, Feodosia, Kerch, Yalta and Yevpatoria (55% of residential population of Crimea is concentrated here). This uneven distribution of population on the peninsula and the presence of multiple links determine the peculiarities of the diffusion of epidemic diseases in the existing system of settlement and the network of settlements in the region.

The population of Crimea according to the data from 01.01.2011 amounted 1954.8 thousand people. The population of Crimea is 4.2% of the population of Ukraine, occupying the 8th place among the regions of Ukraine. The local population settlement system is formed in connection with extending of a large number of medium and small cities and townships. The organizing factor in the process of settlements localization is the presence of large cities and high level of transport and economic development of the area of the region. The natural population growth is negative - 2.7 ppm (2010). In 2010 the number of births per thousand persons was 8.11, the number of deaths - 5.14 ppm. There is a general downward trend in mortality, but the leading cause of death is the death from the disease. For example, in 2010 the proportion of deaths due to the cardiovascular diseases was 69%, due to neoplasmas was 12%. The share of deaths from the infectious and parasitic diseases in the general structure of the Crimean population mortality increases.

Analysis of the incidence and morbidity of population of the ARC (2001-2010). The structure of the sickness rate and morbidity for the period 2001-2010 has not changed and is characteristic for the non-epidemic pathology type of the population, that is, 70-80% of all the diseases account for non-communicable diseases.

There is a general increase in the morbidity of the population of Crimea. The increase of the morbidity is due to the growth rates for the most classes of diseases in Crimea. The highest rates of the morbidity among the entire population of Crimea were marked in Simferopol (185,317.0), Yalta (165,137.8), Yevpatoria (158,933.4) and Saki area (179,818.3); the low rates - in the regions: Kirovsky (109682.0), Leninsky (117,132.1) Nizhnegorsky (116,372.1) and Chernomorsky (125,728.1). For the year 2010 the outpatient clinics of Crimea (children + teens + adults) registered 2,912,531 diseases among the whole population, which accounted 148,856.7 per 100 thousand persons, as well as the growth in the number of diseases by 3.5%.

The primary morbidity has declined in virtually all types of diseases. The exception

is the infectious and parasitic diseases, and the diseases of the genitourinary system. It is indicative of the fact that while the overall level of morbidity in Crimea is reduced, the morbidity with infectious diseases and diseases of the genitourinary system increases. It seems that the main reason is the quality of water (and, above all, drinking water), and the general lack or the limited amount of water (especially in the steppe regions of Crimea).

The overall negative trend in the change of the health status of the ARC population is the growth of the diseases of the endocrine system and respiratory system. For example, the level of respiratory morbidity has increased over 2010 by 1.4%. Among the total population of Crimea, the highest rate of morbidity is observed in the class of "Diseases of the circulatory system." In 2010 it was 881.0 per 100 thousand persons (increase from 0.9% in 2009) and the sickness rate - 244.9 (+0.3%). Most of the cases identified in 2010 and belonging to the class of diseases of the circulatory system, are the following ones: hypertension (46.1%), ischemic heart disease (31.3%) and cerebrovascular disease (15.4%).

Simferopol and Simferopolsky region are the regions with the highest rates of morbidity and the sickness rate. For some groups of diseases and Simferopol and Simferopolsky region are the "leaders." For example, in Simferopolsky region the maximum levels of the morbidity with urolithiasis (N20) are observed (compared to general Crimean ones).

There is a general upward trend in morbidity. The region is also the leader in the group morbidity with the diseases of the digestive system (K00-K9).

It was not possible to establish the correlations between the dynamics of the surface water quality and the dynamics of morbidity of the ARC population due to a number of objective reasons: the inadequate information collection system in the monitoring networks of the ARC (the spatial arrangement of the points, the modes of data collection, the set of indicators, etc.), the lack of coordination of the departmental monitoring networks and their weak interaction, low access to the information because of its status "for special use", the lack of information volume and continuity of the series of dynamic information and the parameters that were used for the analysis.

The analysis of the public health should be based both on the traditional large-scale studies of the morbidity and the studies on the adaptability of the population of the individual regions, which will allow to identify the most important factors for the health, and in the future to determine their safety level. Perhaps the factor of the quality of the surface and drinking water will be among these factors in certain other regions.

Studies of the effect of surface and drinking water on human health of the Autonomous Republic of Crimea took place in the framework of international project 7th Framework Programme of the European Union Building «Capacity for a Black Sea Basin Observation and Assessment System supporting Sustainable Development - EnviroGRIDS @ Black Sea Basin». A.Ya. Bondarev

#### WOLF AS BIO-INDICATOR OF ECOSYSTEMS' CONTAMINATION. RESULTS OF OBSERVATIONS IN THE ALTAI REGION OVER 30 YEARS

Altai State Agricultural University, Barnaul

In fish and other animals of the Arctic Ocean pesticides have been detected. It is believed that pesticides get into the Ocean with the river water. Since 2005 the Arctic Council countries (Denmark, Norway, Sweden and Canada) have been making allocations to Russia for the disposal of obsolete pesticides. In the Altai Region more than 4,000 tons of toxic chemicals were not stored properly. Up to 1982 in the Region DDT and hexachlorane (HCH) were applied. The dynamics of the concentration of those pesticides in the bodies of wolf (Canis lupus L., 1758) has been studied over the period of 30 years, since 1976. Wolf as a bioindicator and monitor species complies with 17 indicators recommended by Sh. Tanabe and A. Subramanian (2006). Wolf families differ from other predators by their sedentary life, and they guard their home range from the congeners.

In the 1970s and 2000s, by gas chromatography (Klisenko et al., 1972; Klisenko, 1977) brain, fat and muscle tissues, liver, lungs, kidneys and other organs of wolves were examined to define the content of alpha and gamma isomers of HCH, DDT and its metabolites (Bondarev et al., 1976). In wolves which inhabited in the plain animal farming areas the following was detected: mg/kg content of alpha-HCH was the highest in liver – up to 0.002, and in kidneys, lungs, brain and muscle some traces were detected; the highest concentration of gamma-HCH was detected in kidneys and lungs – from 0.027 to 0.050, and only traces in brain, heart and muscles. DDT – some traces in liver, brain, heart, and the traces up to 0.18 in lungs. As for non animal farming areas of the Region, wolf commonly inhabited the forest areas. DDT and HCH were not detected there, or just some traces were detected in the concentrations of less than 0.002 mg/kg.

By the year 2000 the wolf remained only in the mountains and vast forests little affected by anthropogenic activities and where no pesticides were applied. After 30 years a multifold increase of wolves' contamination with DDT and HCH has been detected. DDT and its metabolites have been revealed in many organs and tissues of wolves, and in wolf pups also in corium (skin). The content of HCH and its derivatives has also become common in all organs. Now, the maximum content values are 100 times, and the average values are 7.5 times higher. In wolf cubs the concentrations of organochlorine pesticides are much higher than in adults. HCH content in liver in wolf cubs is 3.6 times higher than in adults. DDT in wolf pups reveals the highest concentration in corium – 3.081 mg/kg. The intoxication of young animals occurs with mother's milk. The changes of pollutants' accumulation of over a period of 30 years have been studied by wolves' skulls. Cadmium concentration tends to increase ( $0.011 \pm 0.001$ ), lead concentration has reliably increased up to  $0.629 \pm 0.132$  with simultaneous reduction of strontium-90 concentration up to

#### Programm Abstracts

29.8  $\pm$  7.0, which is probably due to the end of its half-decay period after the nuclear tests at the Semipalatinsk Nuclear Test Site. Perhaps, the dynamics data of strontium concentration in bones may be applied to trace the periods of its greatest discharge during nuclear weapons tests and accidents at nuclear power plants. The concentrations of HCH (0.014  $\pm$  0.003) and DDT (0.062  $\pm$  0.029) in wolves' bones in the 2000s are multiply higher than the values of the 1970s.

The average fertility of she-wolves over the recent 25 years has decreased compared to the period of 1955-1984 by 18.7%, and in 90 litters the fertility amounted to  $6.25 \pm 0.23$  pups (P <0.01). In the period of 2000-2009 the fertility declined even more – up to 5.97 ± 0.39 pups (in 34 litters). The decline of she-wolves' fertility may be the result of a chronic multiple-factor intoxication of their organisms.

M.K. Cherkashina

#### LEGAL REGULATIONS ON PRIMARY ACCOUNTING IN THE SPHERE OF WASTE TREATMENT IN UKRAINE

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An important role in information support of waste treatment is given to the state accounting which is compulsory to all wastes that are formed on the territory of Ukraine and are subject to the law of Ukraine "On wastes" of 05.03.1998.

According to No.2034 Decree of Cabinet of Ministers of Ukraine of 01.11.1999 "On adoption of the Procedure of state accounting and classification of wastes", state accounting of wastes is based on the data of observations over waste formation as well as their treatment procedures and comprises primary waste accounting and state statistical reporting on them. Primary waste accounting is made by enterprises in accordance with standard form of primary accounting documents. The source of primary information on derelict wastes is a derelict wastes treatment commission act drawn up according to "The regulations on discovering and accounting of derelict wastes" adopted by No 1217 Decree of the Cabinet of Ministers of Ukraine of September, 3, 1998.

All the reports are based on the primary accounting. The form of the primary accounting has much wider application compared to the other documents – the majority of production processes of most enterprises produce wastes every day. As for waste treatment, the primary accounting must record the amount and types of wastes that are formed on the enterprise, received from other proprietors, recovered, transferred to other proprietors etc; as for technological processes and waste properties it must be based upon waste inventory taking and identification; as for complexity it must have a reasonable form.

At present, in effect is No 1-BT form "Accounting of wastes, packaging materials and containers" adopted byNo 342 order of Ministry of environmental protection of Ukraine of 07.07.2008. The given form can not provide due functioning of primary accounting since it does not account wastes received from other proprietors or transferred to other

proprietors, i.e. it does not cover all waste treatment operations. Hence it can not be used for producing statistical accounts. The form is too complex to be completed on the lower level as it contains unreasonable number of classifiers both external and internal. Waste classification characteristics must be determined at the stages of inventory taking and identification that almost always precede the primary accounting and are performed only once.

Thus, to provide a due primary accounting its form should be changed. Specifically, the form should be presented as stitched registers each on separate type of waste within one facility or technological process. At the end of calendar quarter, it is recommended to make records that show total waste amount of each operation during the corresponding quarter. The last record of the register should indicate the amount of residual wastes on the date of the register completion.

Attention should be also paid to the creation of a consolidated enterprise reports containing summarized information on the waste owners that deliver or receive wastes. This is the way to creating backgrounds for precise waste tracking and for higher responsibility, including the financial one, of all entities that deal with wastes at different stages.

The forms of primary accounting given above will secure waste traffic control within a single enterprise, waste turnover with other enterprises and harmonized affirmative, accounting and report documenting, which will provide higher quality waste accounting.

Nikolay Danilov Jakow Schtschelokov Maria Stepanova	ENERGETISCHE	ANALYSE	IN	BETRIEBEN
	UNTER RUSSISCHEN VERHÄLTNISSEN			

Uraler Föderale Universität, Institut für Energieeinsparung des Gebiets Swerdlowsk, Jekaterinburg

Die vorgeschlagene energetische Analytik der Wirtschaftstätigkeit zieht in-und ausländische Entwicklungen, darunter ISO 50001:2011 in Betracht, steht vollständig mit den in Russland gültigen Normen in Einklang und gibt dem Betrieb ein universelles Analysewerkzeug zum Monitoring der Energieeffizienz sowohl des ganzen Betriebs, als auch der einzelnen Fertigungsstraßen und Baugruppen; zur Prognostizierung von entsprechenden Kennziffern und operativer Reaktion auf die sich ändernden Verhältnisse zwecks Sicherung und Erhaltung des zulässigen Niveaus der Energieeffizienz und folglich von allgemeinen wirtschaftlichen und finanziellen Kennziffern.

Die Analyse wird auf mehreren Ebenen realisiert: im Betrieb; bei einzelnen Verbrauchern – in Produktionsabteilungen und Fertigungsstraßen; Anlagen; auf der Ebene von Systemlösungen (Aufdeckung und Einführung von fortschrittlichen komplexen Brennstoffund Sekundärabfall- verwertungsverfahren). Der Hauptunterschied von gewohnten Modellen besteht in der Anwendung von komplexen Ressourcenindikatoren (Verbrauch von Brennstoff-und Energieressourcen pro Produktionseinheit in Naturaleinheiten)

und energiewirtschaftlichen Indikatoren (derselbe Verbrauch pro Produktionseinheit in Rubeläquivalent).

Neben der herkömmlichen Betriebsenergieintensität der Produktion kann man volle Energieintensität berechnen. Das ist Energie-und/oder Brennstoffverbrauch für Fertigung von Produkten, einschließlich der Kosten für Gewinnung, Förderung, Verarbeitung von Boden-schätzen und Erzeugung von Rohstoffen, Materialien, Bauteilen unter Berücksichtigung vom Roh-und Werkstoffausnutzungskoeffizient, d.h. in der ganzen Fertigungskette. Somit stellt dieser Kennwert den Verbrauch von allen Energiearten in dieser und in allen vorgelagerten Arbeits-stufen des technologischen Prozesses dar, umgerechnet auf den für deren Erzeugung erforderlichen Brennstoff (in kg von Einheitsbrennstoff pro Produkteinheit) abzüglich von sekundären Energieressourcen. Dieser Kennwert ist eine objektive energetische Charakteristik des technologischen Prozesses, ein Kennwert der vollen Energieintensität von Fertigprodukten.

Dabei sind gleichzeitig alle relevanten Faktoren, die den Energieverbrauch im technologischen Prozess beeinflussen, zu untersuchen und zu optimieren. In erster Linie sind Probleme in begrenzenden Gliedern der Fertigungskette zu suchen und zu lösen.

In jedem Leitungszyklus, nach einer Optimierung oder sogar Modernisierung wird eine Vergleichsanalyse durchgeführt, die die erreichten Ergebnisse im Vergleich zu besten praktischen Ergebnissen in dem Industriezweig zeigt. Wichtig ist hier eine Vergleichbarkeit der Daten auf der Ebene von Betrieben, technologischen Prozessen, Industriezweigen u.s.w. zu sichern, dazu soll auch eine Vereinheitlichung von Berechnungsverfahren beitragen. Der vorgeschlagene Kennwert der vollen Energieintensität der Produktion kann zur wichtigsten energetischen Charakteristik des technologischen Prozesses und des fertigen Produkts werden und kann im Pass (Zertifikat) des Erzeugnisses angegeben und bei Berechnungen in weiteren Arbeitsstufen in Betracht gezogen werden.

Schlussfolgerungen

1. Unter herrschenden Verhältnissen können Betriebe und Organisationen ihre Wettbewerbsfähigkeit ohne Einführung vom Energiemanagementsystem nicht sichern.

2. Als wichtigste methodisch Grundlage für Einführung von ISO 50001:2011 wird die energetische (energieökologische) Analyse empfohlen.

N.A. Danilova

## ENVIRONMENTAL SCIENCE: INTEGRATION OF EDUCATIONAL AND PROFESSIONAL APPROACHES

State Budget Educational Institution of Secondary Professional Education, College of Fire Fighting and Life-Saving Education "St. Petersburg Rescue Training Centre", St. Petersburg

The aggravation of global problems and the environmental crisis on the planet has led to the fact that in the third millennium the humanity has to face the eternal questions about the purpose of life, essence of nature and the place of the human being in it in the new light, with the yet unprecedented acuteness.

The methodological basis of the formation of the natural-scientific knowledge today is the teaching about the unity of nature and man, i.e. about the application of the systematic approach towards the organisation of the science-based nature management.

The development trends of the natural-scientific education in the St.Petersburg's school are implemented on the basis of principles of humanization, orientation towards the humanities and integration of the educational content, all of which are dictated by the global courses of the modern philosophy of education (global studies). These principles represent the basis of the transformation of science into educational knowledge.

We direct the natural-scientific training of our students towards mastering the basics of natural-scientific expertise alongside with acquiring the humanistic ideals. Having analyzed the contents of the professional educational courses ("Environmental Chemistry", "Industrial Environmental Science" etc.), we have come to the conclusion that the principle of isomorphism is the most suitable one. To be precise, the principle of isomorphism can be explained on the example of the main parameters of the system "nature-man", the scientific model of the description of this system as well as the natural-scientific education and courses of school subjects. We treat the notion of "isomorphism" as a general scientific notion – the similarities in the structure and organisation.

Great attention is also paid to the tendency towards the humanities in the naturalscientific education. It means integration of various school subjects around the problem of interaction between the human being and nature. The main mechanism of the orientation towards the humanities in the natural-scientific education is the integration of knowledge.

This educational system is directed to create a professional and creative personality of the future specialist. The College of Fire Fighting and Life-Saving Education "St. Petersburg Rescue Training Centre" is the only college in the city that has been training technically qualified students with the qualification "ecologist" for the last 2 years. The main attention in our college is paid to the integration of the creative and practiceoriented knowledge. We are creating a programme of continuous education in the system of secondary and higher education in this area of studies. It is important to note that both teachers and students of the College of Fire Fighting and Life-Saving Education take part in the research work.

Besides the equipment in the school laboratories, the environmental department of the college has a transportable module to control the state of the environment. The purpose of this module is to guarantee the control of the local environment situation (radiation, chemical balance), both under ordinary circumstances and in emergency situations. In order to carry out the research, in 2011-2012 teachers and students visited the river basins of the Ohta and the Okkerville. The environmental state of water bodies was assessed. The samples of water, ground sediments and soil were analysed for metal and metal oxide ions. The concentration of carbon dioxide, nitrogen oxide and sulphur in the air was

determined with the help of express methods. It is planned to carry out the environmental monitoring of this area every year.

What we try to achieve is for our graduates to not only have the professional knowledge but also have a high natural-scientific culture. It is an absolute must for an ecologist to have an integral world view.

N.K. Dosmukhamedov A.N. Lezin N.M. Tokenov **ECOANALYTICS IN MINING METALLURGY** Scientific research center «INTEGMO», «AspapGEO» LLP, Almaty

Nowadays development of Mining Metallurgy Sphere (MMS) should be characterized by dominating innovation processes; the basic there is practical implementation of new knowledge, aimed at deciding such conceptual problems as ecological, economical and technique-technological, raw materials complex use and resource-keeping. In the considering viewpoint, the discussion in scientific literature, concerning development and application of high-precision X-ray fluorescent analytical devices in MMS, is quite principal.

At the moment, both abroad and in CIS countries, in MMS there are being implemented power dispersion X-ray fluorescent (stationary and portable) devices of such foreign companies, as: «Bruker» and «Spectro Analytical» (Germany), «Oxford Instruments» (Great Britain), «Niton» and «Innov-X Sistems» (USA) and others. There also known such devices, made in Russia, but they are not being widely used in practice. In the list of such developed products it is impossible to sidestep X-fluorescent power-dispersion devices of Kazakhstani manufacturers – stationary laboratory device - RLP-21 and portable one – RPP-12 (manufactured by «AspapGEO» LLP).

RLP-21 is developed for defining elemental composition of wide range of products, obtained through MMS activities in the Republic of Kazakhstan (RK). RPP-12, by its functional characteristics is mainly being used for sampling in heavy working conditions: in mines, pits, cores, pieces of stone and ore samples in nature. During last 10 years the developed devices were applied on huge MMS enterprises of the Republic and on a number of structural divisions of the National Bank of Kazakhstan (Cash operations and care-of-valuables center, Mint and others). Nowadays more than 100 RLP-21 and RPP-12 devices are being successfully operating. Note, that the devices, implemented for "Kazakhmys Corporation" in 1985 are still operating there.

It proves high-reliability of the devices. Such huge enterprises, as «Zhairemskiy GOK» OJV, «Kazcink» LLP and most structural divisions of «Kazakhmys Corporation», are still being equipped with the local RLP-21 and RPP-12 devices.

The registration and control over precision metals and harmful substances through all the units of technological scheme provided favorable conditions for automatic

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management systems over technological processes. This approach allowed regulating ecological monitoring system on-line. As a result, there were achieved high rates of raw material complex use, resource keeping and environment safety.

The existing considerable systematic theoretical material increased the spectrum of scientific research works, aimed to concrete MMS tasks solutions. Recent years, according to the enterprises orders there are being made aggressive investigations on creating X-ray-fluorescent devices for uranium manufacture, chemical and other Kazakhstani economies. The most actual is portable device, being developed by the authors, equipped with ultrarapid SDD detector and microsized 50 kV X-ray tube. The device is oriented, first of all, on naturally bending ore analysis and will be adapted to the automatic system of ore sampling in material mining conditions. The final aim of the complex being developed is supporting high level of personnel security and sampling efficiency.

S.G. D'yachkova N.D. Gubanov

#### SCIENTIFIC AND TECHNICAL DEVELOPMENTS, MASTER DEGREE AND BACHELOR'S PROGRAMS AT THE FACULTY OF CHEMICAL ENGINEERING AND METALLURGY

National Research Irkutsk State Technical University, Irkutsk

Irkutsk State Technical University (ISTU) is one of the largest universities in Russia. There are more than 32000 students undergoing training in 89 specialties. In 2010 ISTU was awarded with the category "National Research University", and receives considerable government subsidies for the development of University scientific base. Faculty of Chemical Engineering and Metallurgy is one of the oldest faculties at the University. In 2010 the faculty celebrated its 80th anniversary. The faculty is permanently developing. The Faculty consists of 4 departments delivering training in 6 specialists programs, 4 bachelor 's and 6 Master degree programs. Department of the Faculty of chemical technology and metallurgy have creative ties with institutes of Russian Academy of Sciences, leading regional industrial enterprises Scientific and technical developments.

Research activity at the Faculty has always played a crucial role in its development. Scientific interests of the Faculty staff are broad enough, but still can be united under the general topic "Fundamental and applied aspects of processing of hydrocarbon, vegetable and mineral raw materials":

1. "Solution of technological problems aimed at raising of depth and quality of oil processing"

• design of petroleum refineries of low power (mini refineries)

• research of technological and hydraulic parameters of rectifying columns and making decisions on maximal output of clear products

• research of qualitative and quantitative composition of hydrocarbon materials, intermediate materials and products of processing

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• efficient and relative inexpensive inhibitors were developed to be used in petrochemistry, processing of different vinyl monomers and their mixture with special emphasize to Russian products.

• some developments successfully passed experimental-industrial and industrial testing.

2. "Development of schemes of efficient complex use of refinery waste"

• . Chemistry and technology of oil penetrating-type materials (antirot substances) with advanced operational and ecological properties on the basis of refinery waste

• Use of heavy pyrolysis tar as an activator of mineral powders for road construction, as a component of a plasticizer of polymer-bitumen binding agents and electrode binders.

• Use of bitumen and heavy petroleum residues as binders by briquetting of mineral and carbon materials.

3. "New approaches to selective assembly of heterocyclic structures on the basis of raw materials available in industry"

• New technological methods for production of unsaturated heteroatom compounds of acyclic and heterocyclic structure were proposed. New compounds with useful properties were synthesized:

• New data about little-studied processes of nucleophylic substitution by sp- and sp2hybridized carbon atom were received.

4. Fundamental and applied research in the filed of "Biotechnology and chemistry of biologically active substances made of vegetable raw materials"

5. Development of physical and chemical bases for raising efficiency and ecological safety of aluminum production, study of distribution of emissions in the zone of aluminum plants influence

The present and the future of the Faculty of chemical engineering and metallurgy are its close relations with industrial enterprises; it's furthermore high-quality teaching staff.

O.A. Diachuk G.V. Melnikov E.I. Tikhomirova THE LUMINESCENCE METHOD OF POLYCYCLIC AROMATIC HYDROCARBONS DETERMINATION

Saratov State Technical University, Saratov

Solid-phase extraction is widely used to determine many inorganic and organic compounds. The method combines the adsorption preconcentration of substances (solid-phase extraction) followed by the luminescence determination directly in the adsorbent phase without the desorption of substances with organic solvents.

It is known that, in the solid-phase luminescence, luminophores are immobilized on various matrices. Filter paper has received the widest application; its cellulose fibers are capable of immobilizing different substances on the surface. In using this matrix, both the fluorescence and phosphorescence of most substances are seen to contribute to the selectivity of the analysis. However, the preconcentration rate of hydrophobic polycyclic aromatic hydrocarbons is low because of the hydrophilicity of the adsorbent. It is known that, to increase the efficiency of the preconcentration, the surface of the cellulose matrix is coated with various substances.

We studied the determination of PAHs by solidphase luminescence using the adsorption from microheterogeneous media containing an anionic surfactant (sodium dodecyl sulfate, SDS) and a nonionogenic polymer (polyethylene glycol, PEG 1000), on cellulose.

It was previously found that the addition of a nonionogenic polymer into an aqueous micellar solution contributes to the micelle formation of the surfactant. However, the effect of the composition of micellar media on the adsorption of PAHs by solid matrices and on their luminescence properties has not been studied.

The spectral characteristics of PAH both in an aqueous solution and adsorbed on a solid surface was studied by an example of pyrene. Pyrene is a luminescence probe; the polarity of the microenvironment of pyrene can be judged by the ratio of the intensities of the first and the third peaks in the fluorescence spectrum  $(I_1/I_3)$ .

It was found that the fluorescence intensity of pyrene in the adsorbent phase was higher than that in the aqueous solution that was used for the adsorption. In the adsorption of pyrene from the aqueous solution, the polarity index decreased from 1.67 for a solution to 1.33 for cellulose. In the case of the cellulose matrix, phosphorescence was observed along with fluorescence with the modification of the matrix by the heavy metal ions.

It is known that micellar media can be used to improve the analytical characteristics of the luminescence determination of substances in solutions.

In order to select the optimal conditions for modifying solid matrices by the surfactant, we studied the dependences of the fluorescence intensity and the polarity index of pyrene on the concentration of SDS in aqueous solutions in the presence and the absence of PEG. It was found that, in the absence of PEG, the total luminescence intensity increased while the polarity index of pyrene decreased at the critical concentration of micelle formation of SDS ( $8 \times 10^{-3}$  M), which was in agreement with the literature data. This can be explained by the solubilization of pyrene in the hydrophobic part of a micelle. The addition of 0.01 M of PEG in the solutions increased the luminescence intensity and decreased the polarity index of pyrene even further with lower concentrations of SDS in the solutions. This indicates a decrease in the critical concentration of the micelle formation of SDS in the presence of polymer molecules.

The solid-phase luminescence of PAHs was studied in the dynamic mode of adsorption. The optimal concentration of SDS was 0.01 M.

It is known that noninogenic polymers contribute to the stabilization of the structure of a surfactant micelle. Therefore, we suggested that, with the use of noninogenic polymers, a larger amount of micelles with solubilized pyrene would be retained on the adsorbent surface, which would contribute to the intensity of the solid-phase luminescence of pyrene. The concentration of PEG of 0.01M in the aqueous micellar solution of pyrene was experimentally selected, at which the highest signal of the solid-phase fluorescence and phosphorescence of pyrene was observed. Probably, the matrix acquired the hydrophobic properties and retained pyrene solubilized in SDS micelles more effectively.

The luminescence intensity both in solutions and in solid matrices linearly depends on the concentration of PAHs in the solution.

The addition of PEG in the aqueous micellar solution decreases the fluorescence detection limit of pyrene both in the solution and in the solid matrix. Similar results were obtained for the other PAHs.

Thus, the adsorption of PAHs by the modified cellulose considerably decreases the detection limit of PAHs in aqueous media. The best results were obtained in the determination of PAHs using the preconcentration in the microvolume of SDS micelles modified with polyethylene glycols followed by the solid-phase extraction of PAHs and the analysis in the adsorbent phase.

A.S. Elderhanova A.A. Atayeva E.I. Tikhomirova

#### ASSESSMENT OF BIOLOGICAL ACTIVITY OF SOILS IN DIFFERENT REGIONS OF CHECHEN REPUBLIC

### Chechen State University, Grozny

Saratov State Technical University, Saratov

It is well known that ecological condition of soils depends on three groups of factors: pollution parameters, soil properties, and environmental variables. The first factor group includes chemical structure of pollutants, their concentrations in soil, time that passed from the moment of initial contamination by a pollutant, etc. (Kolesnikov, 2004). The second group of factors is comprised of soil structure, particle size distribution, humidity, content of humic substances, microbiological activity, and rates of biochemical processes in soils. The environmental variable group encompasses temperature, wind speed, solar radiation levels, proportion of ultra-violet radiation in solar radiation, vegetation cover, etc. Therefore, while planning and conducting comprehensive assessment of soil status, it is necessary to ensure that all relevant environmental variables and factors are measured simultaneously.

The integrated index of soil biological condition (IISBC) was proposed for environmental assessment of soils (Kolesnikov et al., 2002). Its computation requires collection of data on soil biological activity, soil toxicity, soil enzymatic activities, and microbial flora in soils. Knowledge of species composition and densities of microbial flora is of particular importance because microbial flora and microfauna require specific environmental conditions to provide soil ability to cleanse itself from contamination.

We studied various types of soils in Chechen Republic. With this goal in mind, we

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conducted microbiological, toxicological and chemical analyses of soil samples.

We identified qualitative and quantitative composition of microbial communities in soils by planting soil solutions on various diagnostic nutritive media. We then counted colony forming units (CFU), and studied morphology of microbial cells and colonies. Toxicity of soil samples was assessed by employing bioassay test methods using crustacean Daphnia and alga Chlorella as bioassay objects.

We also conducted ionometric and potentiometric analyses of soil samples for heavy metals, determined soil respiration rates using conventional methods, and assessed potential biological activity of soils. The latter was measured in vitro by creating optimal conditions for natural soil processes.

Thus, our comprehensive study of various soil types was the first of the kind conducted in Chechen Republic. Our results revealed the presence of heavy metals in soils within maximum permissible concentrations (MPC). The results of toxicity assessment of soil samples matched with the data on heavy metal concentrations accumulated by bioassay test-objects Chlorella vulgaris Beyerinck and Daphnia magna Straus.

Simultaneously with bioassay studies, we estimated soil respiration rates as an integral index of soil biological activity. We discovered significant reduction of soil respiration in the soil samples from areas with anthropogenic impact.

As for results on microbial composition of soil samples, they showed numeric changes in microbial content of various taxonomic groups. In soils affected by anthropogenic impact, we observed slight decrease in total microorganism abundance and also fluctuations of microbial densities affecting the rates of microbiological processes in those soils.

Raisa Erzhapova Razet Erzhapova Magomed Khasikanov

## PECULIARITIES OF VEGETATION IN THE ITUM-KALE REGION

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The first thing that attracts attention when visiting the Itum-Kale region is its unique vegetation and its clear contrast to the xerophyte flora of Ingushetia, Ossetia, Balkaria and Karachay. Shrubs – typically sibljak – prevail in the flora of the semiarid zone. Visually, this flora can be easier related to certain types of vegetation in the Dagestan and Armenian Highlands than to the xerophytes of the rest of the Tersk region. The sibljak here does not grow in form of scarce patches but as rich closed shrubs, taking up vast areas. Besides sibljak, the Itum-Kale region has prairie fragments, friganoid groups, broad-leaved forests – mainly in form of tiny islands on the corresponding meadow slopes (northern slopes of the Argun valley), rock and shingle vegetation. However, the first place is taken by the sibljak. Vegetation to the west of the Itum-Kale is normally full of steppe-like formations with such types as Festuca, Koeleria, Teucrium, Scutellaria, Botriochloa, friganoid-steppes

.....

and friganoid complexes.

Special attention must be paid to the fact that the flora of the Itum-Kale is a genetically heterogeneous formation. Out of the registered 243 species, 24% have its origin in the Eastern Caucasus, including the half of Dagestan species (member of families Salvia, Astragalus, Onobrychis, Medicago, Cleome, Galium, Alexitoxicum), 13% are Crimean-Caucasian species which are not found in the Western and Central Caucasus, e.g. Colutea orjentalis (Fig. 2), and the Eastern Mediterranean species of the kind Helianthemum nitidum, common for the northern part of the Black Sea and the Sea of Azov, Central and Eastern Caucasus. Approximately the same amount, 3%, is made up by species of the wide Mediterranean habitat, including Eastern Mediterranean, Caucasus and mountains of Central Asia, e.g. Cotinus coggygiria, Fumana procumbens, Convolvulus lineatus, Paliurus spina-christi, and by Armenian or Armenian-Iranian types, Onosma, Cerasus incana, Celtis glabrata. Other species are more wide-spread in boreal forest and steppe subareas (Northern Caucasian and Pontic provinces), the majority of which being steppes.

It is interesting to note that all the species growing in Itum-Kale are grouped into several ecological complexes, i.e. they are ecologically heterogeneous. These species are mesophyll-meadow, rock-xerophyte, steppe and nemoral. All of them, with an exception of the first complex, are foreign formations in regard to the modern landscape and the surrounding vegetation in the Itum-Kale region. No matter which direction you take from Itum-Kale, you will find mesophyll coenosis everywhere. The only exception is the Itum-Kale region itself. Its flora is an island and must be regarded as a relict one. We also treat the part of the broad-leaved forest mentioned above and all oak woods which stretch up the Argun River as relict species. Such thermophillic broad-leaved forests are typically situated today 15-20 km to the north of Itum-Kale, up to the Rocky Range. The fact that there are forests with Colchian species situated higher than Itum-Kale, close to xerophytes, also cannot be ignored.

The presence of such different complexes, geographically connected to other territories and climates, e.g. steppe kinds connected to the steppes of Ciscaucasia, upland xerophytes to Dagestan, broad-leaved forests to the area of beech formations in the Tersk region, clearly indicates that we do not just have the remaining flora. What we have here is a conglomerate flora, and the complex refugium of Itum-Kale. There is no doubt about the flora and climate of Itum-Kale to be a historic product. They are connected to the mountainous relief, orientation of the Argun canyon and the barrier of the Rocky Range, which explain the very fact of formation of arid basins (Krasnov, 1894). But it is exactly why arid basins and their flora are interesting, that is why they carry valuable information regarding the flora genesis. As to the flora of Itum-Kale, it demonstrates the presence of four group local disjunctions in the Eastern Caucasus:

1. Disjunction between the areas of the steppe complex species: the Itum-Kale region – Tersk, Sunzhensk and Zaterechie Range (Koeleria, Stipa, Festuca valesiaca, Bothriochloa, Elisanthe viscosa, Otites wolgensis, Clematis integrifolla, Galium ruthenicum, Rhamnus pallasii, Amygdalus nana).

2. Disjunction between the areas of the Dagestan complex of mountainous xerophytes: the Itum-Kale region – Central Dagestan (Colutea orientalts, Salvia daghestanica, S. kuznetzovii, Astragalus denudatus, A. haesitabundus, Celtis glabrata, Medicago glutinosa, Onobrychis bobrovii, Euphorbia szovitsii, Cerasus incana).

3. Disjunction between the areas of the foothills sibljak: the Itum-Kale – Bragunsk area of Tersk Range – lowland Dagestan (Paliurus spina-christi, Berberis vulgaris, Rosa Cuspidata).

4. Disjunction of the areas of the broad-leaved forests: the Itum-Kale – belt of broadleaved forests in the underlying mountain horizons (Quercus petraea, Tilia caucasica, Albovia tripartita, Convallaria transcaucasica, Polygonatum glaberrimum, Pyrola media and others).

All the four disjunction are not a random phenomenon, they reflect the past of the given territory. The types representing each disjunction are a documental proof of the existence in the mountain areas of Chechnya and Ingushetia of periods with a climate different to the present one, primarily arid and hot climate, i.e. climate, the very existence of which in the last years of Pleistocene is sometimes denied. If, besides these disjunctions, we take into consideration the systematic location (primarily, the systematic isolation) of the Itum-Kale xerophytes, the presence of real oreo-xerophytes in the Rocky Range area between Guchum-Kale and Ushkaloy (Salvia daghestanica), of sibljak, including Paliurus sibljak to the east of the Tersk Range in Chechnya and Dagestan, up to the Tarki-Tau, the remaining steppe and xerophyte species surrounded by forest vegetation on the slopes of the Sharo-Argun (Festuca valesiaca, Cotinus coggygria), flora on the Tersk and Sunzhensk Range, flora of the western slopes of the Andi Range and the Kezenoy-Am lake area, especially the Hoy village with species Cephalaria daghestanica and Erodium fumarioides, then the disjunctions mentioned above do not only give information about the age of local xerophytes and the time of their infiltration, but also show probable ways of dissemination of species which belong to different ecological groups, the collector of which is the Itum-Kale region.

We acknowledge the fact that xerophytes' dissemination took place from Dagestan across the mountains. However, we believe that the main way of dissemination of sibljak (for its thermophillic species) is a bypass one, across the lowlands. The reality of the latter assumption is confirmed b the modern flora of the Dagestan Lowlands, but it is only true for thermophillic species. We date the dissemination of the steppe species to the middle Holocene period, that of cryoxerophytes to the second half of the Riss-Würm Interglacial Stage. Only by assuming this chronology it is possible to explain the absence of arid formations on the Hyzny-Su and Sukan-Su canyons. They used to exist here, but they were destroyed by the Würm glacier, that reached the Rocky Range. The traces of this glacier can be clearly seen in these canyons. We do not mean the destruction of xerophytes was caused by the mechanical impact of the glacier, but by the climate. Both these canyons are colder than others even today. We do not find clear traces of the Würm glaciation or Jurassic depression in other canyons of Balkaria and Ossetia in the Rocky Range area. The groups of semiarid flora can be found everywhere.

#### Programm Abstracts

Due to the aforementioned facts, the flora in the Itum-Kale region, its forest, meadow and xerophyte cenoses acquire great scientific interest and deserve serious protection. It is already necessary for the simple reason that Itum-Kale is the farthest region to the west in Northern Caucasus where you can still find sibljak from Colutea orientalis and Christ's thorn as well as a relatively full preservation of broad-leaved forests from the early Holocene period.

S.A. Garipova

### FUZZY FILTER. HIGH RATE COMPRESSIBLE MEDIA FILTRATION

Samenviro LLS, Samara

Introduction

One of the most actual problems in the water treatment from different contaminants is suspended solids removal and, of course, fine-dispersed particles from water. Many filtration units can't provide necessary water treatment quality or they require considerable costs for construction and maintenance.

That's why we have needs in searching of new technological decisions which can satisfy modern requirements for water treatment quality, power efficiency, reduction of wastes, automatization and cost reduction for installation and maintenance.

One of the modern decisions is Fuzzy Filter which supplies removal of suspended particles with dimension from 5 microns from different water types.

In 2009 filtration technology on the base of Fuzzy Filters started its development in Russia to help in solving of different ecological targets: from tertiary treatment of domestic waste water before discharge water to the river till process water treatment at the plants with the aim of water use reduction.

Technology

Principle of Fuzzy Filter operation is based on passing of water up-flow through the layer of polymer media of spherical form. When polymer media is in compressed condition it supplies high-performance removal of suspended particles and pores` dimension of the media reaches 5 microns.

During filtration mode the filtration media is in compressed state between two perforated plates, low plate is fixed and the upper one is movable. When filter is in washing mode then upper perforated plate is coming up and the air comes to the lower part of the frame. As the result, balls after water and air washing are straighten, cleaned and recovered with all necessary filtration characteristics. After finishing of washing stage the upper plate is coming down and air supplying is stopped, filtration media is compressed and Fuzzy Filter is in filtration mode.

Comparative analysis of Fuzzy Filter filtration technology with conventional

#### euro-eco: hannover2012:

technologies used for water treatment for suspended particles removal allows to extract main advantages of Fuzzy Filters:

- Very high flow rate (up to 100 m/h),
- Compact build installation,
- Low operational pressure (6 -7 m),
- Low wash water usage, minimal volume of washing water,
- Flexibility through media compression,
- Completely enclosed structures.

Efficiency of operation and application of Fuzzy Filter

"Samenviro" specialists have tested Fuzzy Filter in Russia with different types of water: domestic waste water after secondary settling tanks, natural water, process water.

Treatment efficiency for different types of water according to suspended particles is till 99 %, COD - till 92 %, phosphates - till 45%, turbidity - till 87 %.

With chemicals usage for water treatment and the following Fuzzy Filter filtration the efficiency will increase but the chemicals consumption in comparison with conventional methods is less in 1, 5-2 times.

Test results open wide perspectives for application of this technology on the territory of Russia for solving different ecological problems.

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### PREPARATION AND TESTING OF THREE-WAY CATALYSTS BASED ON PD-RH ALLOYS WITH PREDEFINED COMPOSITION

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The exhaust aftertreatment system of vehicles has been changed considerably over the last 25 years. Automobile exhaust gases are poisonous and carcinogenic substances which significantly impact on environment and human health. Catalytic abatement of nitrogen oxides (NO<sub>x</sub>), CO and hydrocarbons (HCs) can be performed simultaneously at so-called three-way catalysts (TWC) installed within the exhaust pipe. Contemporary catalytic neutralization system consists of three main parts: monolith carcass (carrier), second layer which is also known as washcoat, and active component. Precious metals are usually used as active component due to their high activity and stability. Supported Pd and Pt are active in oxidation of the CO and HCs whereas Rh is mostly responsible for NO<sub>x</sub> reduction.

It is known that TWCs are susceptible to different routes of deactivation. Initially high-dispersed Pd particles may undergo sintering when being exposed to rather high

temperatures. Consequent loss of surface area of the active component leads to decrease in oxidation activity of thermally treated catalyst. Chemical deactivation is much more complex. Rh<sup>3+</sup> formed at high temperature at oxidizing (lean) conditions migrates into the bulk of the washcoat through the defective structure of mixed Al-Ce-Zr mixed oxides. Ions of Rh<sup>3+</sup> are thought to initiate the phase transition of  $\gamma$ -Al<sub>2</sub>O<sub>3</sub> to **G**-Al<sub>2</sub>O<sub>3</sub> (corundum) where they get encapsulated irreversibly. Less than 10% of initial Rh concentration remains on the washcoat surface after treatment.

In this research we have attempted to stabilize the active component on surface of support via controllable synthesis of palladium-rhodium alloyed particles. Pd is believed to prevent Rh from interaction with bulk mixed oxide, and Rh in its turn would impede Pd agglomeration.

The synthesis of catalysts was based on dual complex Pd-Rh salt decomposition on  $\gamma$ - Al<sub>2</sub>O<sub>3</sub>. Pd-Rh ratio was designated by different metals' complexes, thus different composition of bimetallic salt. Catalytic tests were carried out on the installation of flowing-through type at different air/fuel ratio for testing both oxidation and reduction activity. The stability of catalysts has been studied at complex temperature profile and oxygen excess.

R.A. Gazarov

#### DIE PROBLEME DES NATUR-SCHUTZKOMPLEXES DES KAUKASISCHEN MINERALWASSERS DER RUSSISCHEN FÖDERATION UND DIE WEGE ZUR LÖSUNG

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Die besonders beschützte ökologogische Kurregion der Russischen Föderation - die Kaukasischen Mineralwasser (KMW) stellt die einzigartige territoriale Bildung dar, die in den Grenzen des Bezirks des berg-sanitären Schutzes des Vorkommens der Mineralwasser des Kawminwodski artesischen Schwimmbads gelegen ist.

Der besondere Status wurde dieser Region für die Erhaltung der natürlichen Eigenschaften der Kurorte der Kaukasischen Mineralwasser, der Versorgung der rationalen Nutzung der Heil- und Gesundheitsfaktoren, der ausgeglichenen Lösung der Aufgaben des Schutzes der Umwelt, des Naturressourcenpotentials des Territoriums, ihrer sozialökonomischen Entwicklung in den Interessen des Staates gegeben.

Auf dem Territorium der Region KMW von der Fläche 5,8 Tausend Q. km gibt es I. Mio. Einwohner.

Die Region ist in den Grenzen des Südlichen Föderalen Bezirkes gelegen, und zu ihm gehören die Territorien von drei Subjekte der Russischen Föderation: Region Stawropol, der Kabardino-Balkarischen und Karatschaier-Tscherkessen Republiken.

Die größte Stadt der Region ist Pjatigorsk (205 Tausend Menschen) - zweiter nach

Stawropol nach der Bevölkerungszahl die Stadt, die in einer bestimmten historischen Periode den Status der Ortshauptstadt hatte.

Die Städte-Kurorte bilden die Region, wohin vollständig oder teilweise eingehen der II. Gemeindeformationen Region Stawropol, die die Organe der Gemeinde haben.

Die Region KMW - die größte und einzigartige Kurregion der Russischen Föderation, die die wesentlichen Verbesserungen der Gesundheit nicht weniger als 1 Mio. Menschen im Jahr gewährleisten kann.

Auf die Probleme des Naturschutzkomplexes kann man dazu bringen: die Verschmutzung der Umwelt, die Degradation der natürlichen Landschaften, die veraltende materiell-technische Basis, das ungenügende Niveau der Entwicklung der Infrastruktur, zu viel Einwohner der Kurstädte, die Notwendigkeit der Liquidation mehr 30 Spalten, die Senkung des Niveaus der Forschungsarbeiten.

Es wird vorgeschlagen, 5 zweckbestimmte Richtungen der Tätigkeit nach der Erhaltung des einzigartigen Naturressourcenkomplexes KMW zu wählen.

• die Versorgung der gesetzgebenden-rechtlichen Regulierung der wirtschaftlichen und natürlichen Komplexe der Region KMW.

• die Lösung der Probleme der Abfallverwendung von der Produktion.

• die Durchführung der wissenschaftlichen Forschungen nach der Nutzung der Mineralwasser.

• der Schutz der atmosphärischen Luft in der Region.

• die Durchführung von den Veranstaltungen nach der Korrektur des existierenden Transportschemas der Autobähne.

Man kann die Hauptrichtungen der Entwicklung des Kur- und Touristenerholungsko mplexes der Kaukasischen Mineralwasser wählen:

• die Rekonstruktion und die Modernisierung der Objekte des Kur- und Hotelkomplexes.

• der Bau der neuen Kur- und modernen Touristobjekten.

• Entwicklung der neuen Arten von Dienstleistungen.

• Bereitstellung Voraus Resorts und touristischen Dienstleistungen in den nationalen und internationalen Märkten.

• Verbesserung der Qualität des gesamten sozialen und kulturellen Einrichtungen.

• Ausbau der kulturellen und Freizeiteinrichtungen, Neubau von touristischen Einrichtungen, der Ausbau der touristischen Routen.

Der Anstieg der gesundheitlichen Verbesserung der Fähigkeit Resorts in der Region erfordern ein Paket von Maßnahmen und die Verbesserung der rechtlichen Rahmenbedingungen für das Funktionieren der Anlage und Freizeit-Komplex. Die Hauptaktivitäten für die Aufgabe:

• Die Wahl von allen besten geeigneten Flächen für neuen Investitionsprojekten Seiten.

• Ermittlung der wichtigsten Aktivitäten und die Investitionen in die Modernisierung der bestehenden Infrastruktur und der Entwicklung von neuen KMW Infrastruktur.

Programm Abstracts

• Die Entwicklung von Maßnahmen, um die Investition Attraktivität der Region KMW gewährleisten.

• Das Rechtliche Support von KMW zu Investitionsattraktivität . Eine konzertierte Aktion der staatlichen und privaten Investoren

gewährleisten die Umsetzung eines Programms von Erneuerung und Erstellung des High-Performance von Weltklasse-Kurresort und Tourist Komplex.

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#### A WAY AND INSTALLATION OF UTILIZATION OF MUNICIPAL SOLID WASTE BY THERMAL PROCESSING METHODS WITH PRODUCTION OF GASEOUS FUEL

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The problem of utilization of municipal solid waste (MSW) becomes more and more pressing year by year because increase of MSW takes place much quicker than appearance of effective methods of their destruction or processing. Negative consequences are reflected in ecological, in social and economic spheres.

Nowadays development of alternative power sources is an actual problem in powerengineering therefore any researches which are carried out to areas of obtaining energy from organic raw materials are important.

Recently concepts and information messages about technologies of thermal processing of MSW began to appear, but practically there is no information on a constructive embodiment and modes of operation of the equipment. The majority of available technologies assume preliminary sorting and MSW drying. Automation of waste sorting process is an addition problem. As a rule, waste sorting is made manually.

MSW contain from 60 to 70% of organic substances and it creates preconditions to processing them by power effective thermal processes. Energy for processing is supposed to be taken from MSW, making thus new fuel.

The known technology of MSW processing in a burning mode, including processing in furnaces on grid-iron, has a significant shortcoming because it is accompanied by atmospheric air pollution by poisonous burning products.

The technology of MSW thermal processing by pyrolysis and gasification processes is more effective from the point of view of environmental pollution prevention, but has a poor development owing to insufficient study. Pyrolysis consists in irreversible chemical change of garbage as a result of heating without oxygen access. In the course of pyrolysis there is not only disintegration of organic material, but also synthesis of new products: liquid organic fraction and combustible gas (thermo gas). By means of pyrolysis it is possible to process the components of waste which are difficult giving in to utilization. Biologically active substances don't remain after pyrolysis therefore disposal of pyrolized

species doesn't put harm to environment. At the final stage of processing of MSW there are gasification of pyrolized species and drying for receiving thermo gas.

Thermal processing of MSW by pyrolysis and gasification processes is carried out in furnaces of mine type – thermal reactors. Design and operating parameters of thermal reactors, and also an exit of gaseous fuel, depend on processes occurring in them. In the course of thermal decomposition of MSW in partially laminated mode it is possible to allocate three technological zones throughout the height: a pyrolysis zone, a predrying and a zone into which MSW are continuously loaded. Such allocation of zones is connected with expected bad gas permeability of MSW layer therefore warm gases can be filtered up only regarding a layer under the influence of the created pressure difference. Thermal MSW processing in a layer is complicated because unsorted and particularly deposited MSW have considerable hydraulic resistance, and process of movement of gas through a layer is difficult.

Investigation of thermal processes, and also processes of movement of gases in a layer of MSW, pyrolysis and gasification in experimental installations, are actual and timely. Results of researches form a basis for development of technology of MSW thermal processing and receiving gaseous fuel from waste.

In the course of experimental investigation MSW humidity, which characterized by the maximum exit of thermo gas at its maximum calorific efficiency was defined. Also was defined hydraulic resistance of MSW layer which allows calculating optimum height of the reactor. Parameters of operating modes of experimental installations and the equipment are defined. The optimum mode of carrying out pyrolysis and gasification processes for the greatest exit of combustible gas is found.

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#### INFLUENCE OF NANOPOROUS NATURAL MINERALS (ZEOLITES) FROM TERBUNSKY FIELD (REGION LIPETSK); CONTENTS OF PB AND CD IN LEACHED CHERNOZEM

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The possibility of widespread use of zeolite-containing rocks and natural zeolites in the Lipetsk region is due to a solid stock Terbunsky field.

Important characteristics that determine the impact of this mineral on agronomic properties of the soil, are their elemental composition and sorption capacity, which, in turn, depends on the microstructure of the surface of the mineral particles.

We first obtained the results of morphological analysis of the particle surface rocks Terbunsky zeolite deposit and explored the surface of the zeolite particles at magnifications

of 5,000 and 10,000 times. Montmorillonite surface inhomogeneities on the macro - and micro and layered. The pore size ranges from 25 to 300 nm. It is the presence of nano - and meso - then, the relationship between them form the activity of the zeolite system.

Complex topography of the surface of the zeolite can influence the geometry of the adsorbed ions and their energy characteristics, and therefore, the process of sorption. In addition, the role of nanostructures in the interfaces, they are characterized by size effects. It is known that heavy metal cations in solution form hydrated complexes, the radius of which an average of 2 times non-hydrated cation, such as Pb 2 +  $r_{cr} = 125$  nm, and  $r_g = 262$ nm. These distances are comparable with the pore size of the zeolite. Studies allow reasonably be considered minerals Terbunsky field as a natural system with nanoproperties.

The degree of sorption (R,%) describes the effectiveness of the sorbent is substantially dependent on pH and sorbed element. Optimum pH of sorption are specific to each of the studied metal cations and depend on the properties of zeolites. Quantitative sorption of ions Cd 2 +, Pb 2 + Terbunsky zeolite observed at pH 4,0 and 7,5-9,0, respectively 4,4-6,01.

For these purposes, we have laid mikroplot agrofield experience in growing spring rape on plots with increasing doses of zeolite, in doses of 3 and 5 t / ha in the background and without background  $N_{60}P_{60}K_{60}$ . The application of zeolite rocks under rapeseed is a clear downward trend in the exchange (pH<sub>KCI</sub>) and acidity (Hg) of the soil in all experimental variants.

Analysis of the quantitative features of zeolite rocks Terbunsky deposits can be recommended to reduce the risk of environmental contamination of soil Pb and Cd on a one-time payment of leached chernozem at sowing of oilseed crops (spring rape) 3 t / ha as against the zeolite fertilizers (NPK)  $_{60}$  and without application.

J.T. Hadisova A.S. Abubakarova E.A. Aleksandrova INNOVATIVE PARAFFIN-WAX FOR AGRICULTURAL USE COMPOSITIONS

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The goal of our study was creating paraffin-wax compositions from oil to be used as protective cover for agricultural produce to prevent its losses from rotting and decline in quality while at storage. Solid paraffin products from oil are necessary for development of efficient agriculture. For example, these products are used. They are used as a moistureproof coating of grape and fruit cuttings for growing seedlings, or to improve the storage of garlic and onion. Scientifically sound and rational use of solid petroleum paraffins in agriculture requires targeted research of their product-specific operational qualities. So far, there was no scientific evidence for protective coatings in terms of their comparative traits for the right choice of the most effective coating.

We developed and scientifically justified a new formula of hydrophobic paraffincontaining adhesive coating (PK-1) taking into account the requirements for protective coatings of garlic bulbs. It includes ceresine and a surfactant – synthetic fatty monocarbonic acid  $C_{17}$ - $C_{20}$  (SFMA). These components are known to modify the dispersed structure of paraffin. The newly developed PK-1 composition meets the requirements for adhesion, plasticity, and cost-effectiveness.

To clarify the impact of quantitative structure of paraffin-wax compositions on water vapor permeability (WVP), we investigated binary system "paraffin – ceresine (CRS)" and three-component system "paraffin – ceresiny – surfactant (SFMA)". The obtained results showed maximum effectiveness at the addition of 20% CRS and 0.5% SFMA to the paraffin-wax composition. Protective coating PK-1 is prepared by melting paraffin type "T", CRS and SFMA in specified proportions to homogeneous liquid mixture at temperatures 80-85°C in the conditions of thorough stirring.

PK-1 has the following performance properties: melting temperature of 58°C, resistance of 1.0 MPa at 20°C, volumetric shrinkage of 15% at 20°C, plasticity of 0,5  $10^{-4}$  1/MPa, and daily WFP rate of 6.5 g/m<sup>2</sup>.

One of the testing laboratories in Krasnodar concluded that garlic covered with protective coating PK-1 did not contain carcinogenic substances (benzopyrene) even after four months of storage. This finding implied that PK-1 can be safely used for protective coating of garlic without danger of toxicity for humans. To demonstrate the benefits of paraffin-ceresin coating PK-1, we have additionally investigated effectiveness of various know coatings, such as hydrophobic paraffin (P), hydrophobic paraffin-wax PK-4 and hydrophilic coatings based on polyvinyl alcohol (PVA-5), for various garlic varieties at various regimes of storage.

All investigated coating types prevented moisture evaporation for all varieties of garlic. However, hydrophilic coating PVA-5 was 1.5 times less effective than others. The most effective coating was PK-1. It reduced moisture losses three times compared with control for Inglinsky garlic variety, and 13 times for the Tian Shan variety. Pure P-coating had waterproof properties matching PVA-5. It reduced moisture losses 1.3-1.8 times compared with control group. PK-4 coating had intermediate WVP properties between PK-1 and P. It was found to reduce moisture losses four times for the Tian-Shan garlic variety and, on the average, twice for all other varieties.

Therefore, the results of our study suggest that using protective coating PK-1 prolongs storage duration of garlic two times without reduction in bulb quality. We also discovered that paraffin-containing coatings initially inhibiting garlic clove germination, promote garlic growth later on increasing 1.5 times its harvest yield.

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## NEW APPROACH FOR SYNTHESIS OF CoOx/MGO OXIDATION CATALYSTS

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Metal oxides are widely used in the field of heterogeneous catalysis as supports and catalysts. Aerogel technique is well known to be the best way to prepare extremely dispersed nanocrystalline oxides with unique physicochemical and catalytic properties.

Cobalt oxide is one of the versatile materials among the transition metal oxides. Unsupported cobalt oxide is an active catalyst in air pollution control for abatement of CO, NOx and organic pollutants from effluent streams. High surface area mesoporous and shaped form of MgO is desirable for these applications. In present work for preparation of the two-component Co-Mg oxide system the aerogel method has been chosen. Secondary morphology of synthesized samples (Fig. 1) looks very simillar to "nanoflakes" observed in [1] and to magnesium oxide of "coralline" structure obtained in [2]. Aerogel approach to the synthesis of nanostructured oxides opens new possibilities to obtain stable and high effective catalysts which are homogeneous in terms of composition even at high loadings of active component.

The catalytic activity of aerogel prepared CoOx·MgO samples studied in model reaction of CO oxidation will be discussed.

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*Fig. 1. SEM image of nanocrystalline CoOx-MgO oxide prepared by aerogel technique (Mg/ Co molar ratio is equal to 5/1).* 

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Ignat Ignatov Oleg V. Mosin

#### CELLULAR ADAPTATION TO DEUTERIUM OXIDE (2H,0)

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Deuterated cells of various microorganisms adapted to maximum concentration of  ${}^{2}\text{H}_{2}\text{O}$  in growth media (95–98 at.%  ${}^{2}\text{H}$ ) are convenient sourses for preparation of highly deuterated biological active compounds. The deuterated macromolecules undergo the structural-adaptive modificational changes necessary for normal functioning of cells in the presence of  ${}^{2}\text{H}_{2}\text{O}$ .

We have investigated isotopic effects of deuterium in prokaryotic and eukaryotic cells of various taxonomic groups of microorganisms realizing methylotrophic, hemoheterotrophic, photoorganotrophic and photosynthetic ways of assimilation of carbon substrates (methylotrophic bacteria Brevibacterium methylicum, chemoheterotrophic bacterium Bacillus subtilis, halobacteria Halobacterium halobium, blue-green algae Chlorella vulgaris) in the presence of <sup>2</sup>H<sub>2</sub>O with using <sup>1</sup>H-NNR-, IR-, and mass-spectrometry technique.

Our experiments demonstrated, that the effects observed at the cellular growth on <sup>2</sup>H<sub>2</sub>O possess complex multifactorial character connected to changes of morphological, cytologic and physiological parameters - magnitude of the log-period, time of cellular generation, outputs of biomass, a ratio of amino acids, protein, carbohydrates and lipids synthesized in <sup>2</sup>H<sub>2</sub>O, and with an evolutionary level of organization of investigated object as well. The general feature of bacterial growth in <sup>2</sup>H<sub>2</sub>O was the proportional increase in duration of the log-period and time of cellular generation at reduction of outpunts of a microbic biomass. The experimental data testify that cells realize the special adaptive mechanisms promoting functional reorganization of work of the vital systems in the presence of  ${}^{2}H_{2}O$ . Thus, the most sensitive to replacement of  $H^+$  on  ${}^{2}H^+$  are the apparatus of biosynthesis of macromolecules and a respiratory chain, i.e., those cellular systems using high mobility of protons and high speed of breaking up of hydrogen bonds. Last fact allows us to consider adaptation to <sup>2</sup>H<sub>2</sub>O as adaptation to the nonspecific factor effecting simultaneously functional condition of several numbers of cellular systems: metabolism, the ways of assimilation of carbon substrates, biosynthetic processes, and transport function, structure and functions of macromolecules. There is evidence that during adaptation to <sup>2</sup>H<sub>2</sub>O the ration of synthesized metabolites is changing. Furthermore, deuterium induces physiological, morphological and cytological alterations in the cell. This leads to the formation in <sup>2</sup>H<sub>2</sub>O large atypical cells. They are usually 2-3 times larger in size and have a thicker cellular wall compared to the control cells grown on H<sub>2</sub>O. The structure of DNA in deuterated cells in <sup>2</sup>H<sub>2</sub>O may alters;

distribution of DNA in them was non-uniform. The multiplication which would occur in macromolecules of even a small difference between H/<sup>2</sup>H would certainly have the effect upon the macromolecular structure. Breaking up of H–O bonds can occur faster, than <sup>2</sup>H–O bonds, mobility of ion <sup>2</sup>H<sub>3</sub>O<sup>+</sup> is lower on 28.5 % than H<sub>3</sub>O<sup>-</sup> ion, and O2H- ion is lower on 39.8% than OH- ion, the constant of ionization of <sup>2</sup>H<sub>2</sub>O is less than constant of ionization of H<sub>2</sub>O. The maximum kinetic isotopic effect at ordinary temperatures in a chemical reaction leading to rupture of bonds involving H and <sup>2</sup>H calculated as the k<sub>h</sub>/k<sub>d</sub> in macromolecule is in the range of 5 to 8 for C–H versus C–<sup>2</sup>H, N–H versus N–<sup>2</sup>H, and O–H versus O–<sup>2</sup>H bonds.

The data obtained confirm that adaptation to  ${}^{2}H_{2}O$  seem a phenotypical phenomenon as the adapted cells return back to normal growth after some log–period after their replacement into H<sub>2</sub>O. At the same time the effect of convertibility of growth on H<sub>2</sub>O/ ${}^{2}H_{2}O$  does not exclude an opportunity that a certain genotype altered in  ${}^{2}H_{2}O$  is responsible for displaying of the same phenotypical attribute in  ${}^{2}H_{2}O$ .

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#### ISOTOPIC COMPOSITION OF WATER AND ITS TEMPERATURE IN MODELLING PRIMODIAL HYDROSPHERE EXPERIMENTS

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Natural prevalence of deuterium (<sup>2</sup>H) makes up approximately 0.015 at. % <sup>2</sup>H, and depends strongly on the uniformity of substance and the total amount of matter formed in the course of early evolution. Constant sources of deuterium are explosions of nova stars and thermonuclear processes occurring inside the stars. Probably, it could explain a well known fact why the amounts of deuterium are increased slightly during the global changes of climate in worming conditions. Gravitational field of the Earth is insufficiently strong for retaining of lighter hydrogen, and our planet is gradually losing hydrogen as a result of its dissociation into interplanetary space. Hydrogen evaporates faster than heavy deuterium which is capable to be collected by the hydrosphere. Therefore, as a result of this natural process of fractionation of isotopes <sup>1</sup>H/<sup>2</sup>H throughout the process of Earth evolution there should be an accumulation of deuterium in hydrosphere and surface waters, while in atmosphere and in water vapor deuterium contents are lower. Thus, on the planet there is functioning a natural process of separation of <sup>1</sup>H and <sup>2</sup>H isotopes, playing an essential role in maintenance of life on the planet.

Biological experiments with  ${}^{2}\text{H}_{2}\text{O}$  and structural-functional studies with deuterated macromolecules enable us to modelling conditions under which life had evolved. The most favorable are accepted alkaline mineral waters interacting with CaCO<sub>3</sub> and then sea waters.

Circulating in bowels on cracks, crevices, channels and caves karst waters are enriched with  $Ca(HCO_3)_2$ , actively cooperating with live matter. Once appeared in these waters the process of self-organization of primary organic forms in water solutions may be supported by thermal energy of magma, volcanic activity and solar radiation.

The data obtained also can predict a possible way of transition from synthesis of small organic molecules due to the energy of UV solar radiation and thermal activity to more complex organic molecules as protein and nucleic acids. The important factor in reaction of condensation of two molecules of amino acids is allocation of H<sub>2</sub>O molecule when peptide chain is formed. As reaction of polycondensation of amino acids is accompanied by dehydratation, the H<sub>2</sub>O removal from reactional mixture speeds up the reaction rates. This testifies that formation of organic forms may occur nearby active volcanoes, because at early periods of geological history volcanic activity occurred more actively than during subsequent geological times. However, dehydratation accompanies not only amino acid polymerization, but also association of other blocks into larger organic molecules, and also polymerization of nucleotides into nucleic acids.

The data obtained testify that life maintanence depends on phisical-chemical properties of water and external factors – temperature and pH. Hot mineral alcaline water at boiling point, which interacts with CaCO<sub>3</sub> is closest to these conditions. Next in line with regard to quality is sea and mountain water. In warm and hot mineral waters IR-peaks in DNES spectra were more expressed in comparison with the IR-peaks received in the same water with lower temperature. The spectral range of DNES was in the middle infrared range 8-14 m. It is thought that there is the Earth atmosphere's window of transparency for the electromagnetic radiation in the close and middle infrared range. In this interval energy is radiated from the Sun towards the Earth, and from the Earth towards surrounding space. If in the primodial hydrosphere was much more deuterium, this is a significant fact regarding thermal stability of deuterated macromolecules in the preservation of life under thermal conditions, because the bonds formed with participation of deuterium are more durable then those ones formed with participation of hydroden.

#### B.S. Jumakayeva A.A. Ramanova

#### SOME ASPECTS OF ECOLOGICAL EDUCATION IN KAZAKHSTAN

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The main purpose of ecological education is to form active life position of citizens and ecological culture in society based on sustainable development principles.

Ecological education and improvement of professional skill in environment protection area is developing in Kazakhstan as a part of educational system for sustainable development.

It is very important and necessary for Kazakhstan with rich cultural and historical traditions, developing economics to cooperate with countries-participants of international

ecological conventions aimed to improve level of ecological education.

Ecological problems can not be solved by efforts of only ecologists, managers, lawyers, engineers, legislators or authority (power) institutions of society. To effective achievement of aim, to improve ecological safety is necessary active participant of all people irrespective their social or cultural status.

Ecology is highly developed in XX century, it is from biological discipline turned into megascience, including problems of as all natural sciences and so humanities. The highest level of interdisciplinary makes difficult to understand ecology without knowledge of other sciences. Also interdisciplinary means that there are a lot of problems on science junction and have not been studied yet. Owing to these, ecological education requires coordination of different disciplines teaching, introducing of proper chapters to understand ecological problems, working out special courses to study and practical mastering of interdisciplinary questions. That is why raised conception of profile training of specialists separately in biology, chemistry, law, language, etc. appeared corresponding departments in traditional faculties of the universities

Problems of education of sustainable development in Kazakhstan is organically connected with national strategic and political documents on sustainable development: in 1995 was adopted Memorandum Kazakhstan Agenda for the 21st century "For revival and sustainable development of Motherland", in 1998 was adopted Long-dated Strategy of country development to 2030, where one of the main priority of development of republic for the next 30 years was defined on the same level improvement of quality of life of Kazakhstan, also stabilization of environment state qualification, natural resources protection for future generation, in 1998 Republic of Kazakhstan became member of UN Committee on Sustainable Development, in 1998 was developed the National Environmental Action Plan on environment protection based on ideology of sustainable development (NPAEP/SD), with support from UNDP, World Bank, USAID, TACIS, Harvard University of international development and other donors, in 2003 was adopted conception Ecological Safety of Republic of Kazakhstan for 2004-2015, on March in 2006 President of Republic of Kazakhstan N.A.Nazarbaev read annual address to the people of Kazakhstan "Kazakhstan's strategy of joining the world's 50 most competitive countries. Kazakhstan is on the threshold of a major breakthrough in its development", on the 14<sup>th</sup> of November in 2006 on Decree of President of Republic of Kazakhstan was approved The Concept of Transition of the Republic of Kazakhstan to SD for 2007-2024, on the 9th of January of 2007 was adopted Environmental Code of Republic of Kazakhstan. We see, political, legislative and institutional basis for general ecological education has been formed in Kazakhstan.

State education standards are basis for working out educational programs and training aids, educational institutions are responsible for their maintenance. A number of programs and training aids on ecology and environmental protection for pedagogical institutions were worked out in some educational institutions. That is why they may be used as training aids in other educational institutions with some corrections, as they are aimed to orient students for the required minimum of knowledge about the interaction of society and nature, basic ecological laws and factors, forms and methods of environmental protection and rational use of natural resources. Owing to these, modern requirements on ecological education problems demands uniting of power of all departments of educational institutions, which can investigate problems of ecology and environment protection in teaching process of their special disciplines.

Last years is rising question of language of ecology, closely connected with person's consciousness. "Language environment pollution", which is observed by active assistance of mass media, can influence banefully to speech culture of language user.

Ecology of language (linguaecology, ecolinguistics), it is branch of linguistic theory and practice connected with studying of factors influencing negatively to language use and investigation of ways and methods of language enrichment and improvement of specch communication practice. Ecology of language, in theory, must be the basis of language policy of country, especially in the sphere of education, jurisprudence, negotiation processes, business correspondence and of course, mass media activity.

Linguistic ecology involves not only identification of weak points in social-speech practice and formulating corresponding recommendations to subjects of language policy, but also finding out, fixing and propaganda of successful results of language creative works of writers, journalists, politicians, etc.

Social demand of ecolinguistics is defined by rising interest of society to environment problems, including problems of metaphoric modeling of reality in mass consciousness.

Special ecological education founded in our country very late. Approximately 30 years ago, it seemed that to train qualified specialist knowing a lot fundamental disciplines was impossible.

In accordance with Environmental Code of Republic of Kazakhstan adopted on the 9<sup>th</sup> of January in 2007 the purpose of ecological education is forming of life position of citizens and ecological culture in society based on sustainable development principles.

The person mastering ecological culture, submits all types of activities demanding on rational nature use, takes care of environment state improvement, and protects it from pollution.

N.Ya. Kirilenko

## MANAGEMENT OF JET SPRAYS IN DISPERSION TECHNOLOGIES AND HYDROMECHANIZATION

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Devices designed for spraying liquids are used in combustion engines, paintpult, harvesting and other installations. The main requirement for these systems is the need to ensure a high degree of dispersion. In particular, the quality of the technological process of watering is completely determined by the characteristics of the rain, the rain machine, their

conformity to the agricultural and environmental requirements.

Despite the research and study of the issues related to dispersion of liquids, remains urgent.

In the case of a stationary environment the author suggests ways to spray, are due to:

turbulence flow before, creates a pulsating flow in injector pulsation on the limits of the local Jet, circular ripple current flowing streams;

an additional decay of acting parts of a jet with pulsation;

separation of the expiring individual flow jet;

interaction separated flows pouring jet: local coaxial external interaction with the main stream of the ending trickles, through interaction with the outer stream swirling coaxial main jet in the boundary layer, at not coaxial cooperation spewing jets with each other.

In the case of moving environmental solutions are used by spraying:

forced coaxial blowing of medium in the boundary layer flowing fluid;

additional forced blowing of medium in annular resonant cavity;

ejection air supply inside the ring resonant cavity.

Hydro mechanization – how to excavate for development, transport and laying of ground uses energy stream or jet of water.

The solid coherent soils to facilitate its subsequent washout with hydraulic jet using a digging equipment. Working bodies of the affected soil tillage systems prior to the buildup that reduces the effectiveness of the dredger of the elevated energy costs when unloading buckets.

The author developed a device to increase the efficiency of dredging work in soil:

device for emptying the buckets of the dredger is a coastal dirt mass hydraulic jet flow with distribution of reflected lower over all along the inner surface of a scoop.

multibucket dredge – radial washout dirt from the bottom of a scoop jets of water which fills the more elastic the cavity during movements of a scoop.

ladle the dredger-unloading dirt mass from a scoop by addressing the conditions for suction of soil to the inner surface of the enclosure a scoop at the expense of air flow and eliminate dilution zones.

Thus, the developed devices provide increased efficiency by reducing energy costs.

Olena Kotsar Ostap Danchenko Dmitry Kvitko URGENCY TO INCREASE THE LEVEL OF CORRESPONDENCE OF ENGINEERING SUPPORT SYSTEMS IN INDUSTRIAL AND HOUSING OBJECTS TO THE ENVIRONMENTAL CRITERIA

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The deterioration of natural resources and environmental pollution by waste products have a significant influence on the habitat. Nowadays, we can only use less than 1 % of fresh

water without its prior purification. Only in the Ukraine dumps take up approx. 260 000 ha, the territory larger than Luxemburg. At the same time, paper needs 10 and polyethylene 200 years in order to decompose in the environment. The main condition for the humanity to survive is to support the balance between man and his habitat, based on the observance of the condition of safety of his life activity not only for the people in his proximity but also for the nature in general.

A global change in the environment for the better can only happen when taking into consideration the formation of the environmental culture of specialists who work in the area of development and implementation of environmentally friendly technologies, production of ecologically safe materials, power-efficient equipment and automation and computerization devices in systems of use of industrial and housing objects.

The most considerable success in designing, construction and use of buildings made from ecologically safe materials with the use of energy-efficient technologies and equipment during their construction and use has been reached in Australia, Japan and the Netherlands. In particular, since 2004 a voluntary system of environmental assessment of buildings "GreenStar", with the help of which an object - whether it is a building or construction – is assessed according to environmental criteria, has been in use in Australia.

In order to be able to assess the ecological compatibility of engineering systems to support buildings or constructions, we offer to implement the following environmental criteria:

- efficiency of the use of landscape, assessment of the level of influence of the given object on the air , soil, flora and fauna state, quality of underground and surface water on the territories close to the object, observance of the buffer area;

- energy-efficiency of filler structures and architectural solutions, ecological cpmpatibility of the materials used in the construction, with the assessment of their heat-insulating and sound-insulating properties, etc;

- economy in the resource consumption – electric energy (use of low-cost energyefficient electric equipment in engineering systems, use of alternative sources of energy, devices of heat recuperation etc.);

- rational use of fresh water and environmental safety of solid and liquid waste (percentage of recurrent and consecutive use of fresh water, use of recovered waste and rain water for technical needs, quantity and quality of the return water, waste quality and quantity and the possibility of its recycling);

- air quality in the building or construction (microclimate, availability of the computer monitoring systems and optimization of power input for their support, etc.).

In order to increase the level of correspondence of engineering support systems of building and constructions to environmental criteria, UniLOS-Ukraine has created separate systems of drinking water supply and recovered water supply for technical implementation, with the use of rain and return water (waste water, conditioned with the use of biological and membrane technologies), with the recycling of waste into fertilizers, use of automatic support blocks for optimum performance of support systems, technological production processes during the use of housing and industrial objects for the purpose of reducing operational costs.

Khalidia Ksenofontova

### SHAPING AND DEVELOPING THE SET OF MANAGERIAL COMPETENCIES IN AN ORGANIZATION

. Penza State University, Penza

A set of competencies is including the essential skills that personnel must have to achieve company's strategic goals. Company's staff must be aware of such model of competencies. It will help them to acquire knowledge, skills and abilities they need to achieve the organizational goals in accordance with their position in an organization.

A lot of big Western and Russian companies use their own sets of competencies. In ABB company the set of competencies includes only skills and traits of character. IBM and KPMG are sure only skills and abilities should be included. Russian companies such as Sberbank, Russian railways, Wimm Bill Dann Foods formulate a set of competencies taking into account the prompt (not long-term) customer satisfaction.

To our mind, creating a managerial competencies set in an organization one should take into account market conditions, company's scope of activity, its strategic goals, management principles and style, corporate culture and other factors.

It should be stressed it is important for top-managers to possess abilities of strategic thinking, for middle managers to possess highly-developed social skills (the ability to motivate and mobilize subordinates), for first-line managers to know the process of production. However, such models do have certain faults:

- they reveal only general requirements for managers at different levels;

- they do not describe methods of measuring competencies;

- they do not help to develop an effective personnel policy and improve personnel performance.

Therefore, it is necessary to state that

The managerial competencies set should be seen in connection with the environment in an organization.

Managerial competencies in the model should include criteria and characteristics of efficient performance in the process of modernization of the system.

An organization may have different levels of management depending on the industry it operates in, goals (strategic, tactical, short-term), scope of activity (the volume of production), forms of property (state-owned, private, mixed). Considering all these factors organizations define goals and managerial tasks.

Sets of managerial competencies should include a number of units covering economics, general and functional management, marketing; HR management, quality management and others. Components of the competencies (knowledge, skills, abilities) must be structured and interconnected in accordance with the peculiarities of manager's responsibilities at each level and area of management.

#### euro-eco: hannover2012:

T.R.Kunakh

# MONITORING OF TOBACCO EPIDEMIC AMONG SCHOOLCHILDREN

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The human right on favorable environment is legislatively fixed in the Constitution of the Russian Federation (Art. 42) and the most important from them are: «About environmental protection» (2002), «About sanitary-and-epidemiologic wellbeing of the population» (1999), »About fauna» (1995), »About a subsoil» (1992, 1995), etc.

Ecology is the science about the environment as a residence of the human being. The contribution to this science was already brought by scientific antiquities - Aristotle, Hippocrates, Epicurus, etc. Epicurus's postulate is known, for example: «... it is impossible to force the Nature, it is necessary to obey it, necessary desires executing, and also natural if they don't harm. And harmful – severely suppressing» (it is interesting to compare with known to us – in the second millennia – the thesis: «We cannot wait for favors from the nature! To take them from it – our task»).

«The most important indicator of wellbeing and safety of the state, - according to the director of scientific research institute of carcinogen, the member-correspondent of the Russian Academy of Medical Science, the professor D. G. Zaridze, - nation health, people health is. Life expectancy of Russians is shorter, than in the majority of the countries of the world. Mortality of the Russian men of able-bodied age is higher, than not only in the developed countries, but also in China, India, in other countries of Asia, North Africa and Latin America.

Smoking – a main threat to health and one of the main causes for death in Russia. The percent of the death connected with smoking, among the men of middle age who have died of malignant tumors, makes 59 %, mortality from warmly - vascular diseases – 44 %, from chronic nonspecific pulmonary diseases – 70 %. As a result of the advertizing company of unprecedented scale in our country of smokers will be much more. Especially disturbing is that smoking among teenagers, youth and women has increased dramatically in Russia.

The main instrument for the fight against smoking are the legislation, the law limiting production, realization and consumption of tobacco products, and there are valid in more than in 100 countries of the world. In 1999 the European Parliament also approved the instruction in which covers the most important "incentives" stimulating tobacco smoking: ban of all forms of advertizing of tobacco products, including charity, probation of selling cigarettes to teenagers under 18 years, smoking restriction in public and workplaces, restriction of the contents in a tobacco smoke of pitch and nicotine etc.

The assessment of level of tobacco epidemic among youth makes one of the most important aspects of fight for nation health.

The goal of Homo sapiens, i.e. wise men, does not consist in damaging their own basis

of existence but in trying to understand laws and rules, and to coordinate them with their purposes and actions.

Zh.M. Kuzbakova I.D. Rodikov L.V. Mazurova

#### EVALUATING THE DYNAMICS OF BIOGENIC ELEMENTS IN WATER BODIES OF LENINGRADSKY REGION

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Phosphorus is one of the nutrients that are of particular importance for the development of life in water objects. Phosphorus compounds are found in all living organisms. They regulate energy processes of cellular metabolism. In the absence of phosphorus compounds in water, development and growth of aquatic vegetation stops. However, excess of phosphorus leads to negative consequences, causing eutrophication of water bodies and declines in water quality.

Phosphorus compounds occur in natural waters as a result of the metabolic processes of aquatic organisms and their decomposition after death, due to weathering of phosphate-containing rocks, surface water run-off, and household and industrial sewage. Contamination of natural waters with phosphorus is also caused by the phosphate fertilizers, polyphosphates in detergents, flotation reagents, etc. Concentrations of phosphates in clean waters range from 0.01-0.001 mg/l. Higher concentrations indicate polluted water bodies. Phosphate concentrations in water are subject to seasonal fluctuations because they depend on photosynthetic intensity and rates of biochemical decomposition of organic matter. Minimal concentrations of phosphorus compounds are observed in spring and summer while maximum concentrations are detected in the fall and winter. Aquatic organisms consume some phosphates thus reducing their concentrations. Sane effect happens due to sedimentation of insoluble phosphates.

Maximum allowable concentration (MAC) of phosphate (adjusted for phosphorus content) in waters used for fisheries ranges from 0.05 mg/l in oligotrophic waters to 0.15 mg/l in mesotrophic waters, and to 0.20 mg/l in eutrophic waters. MACs of phosphate for drinking water facilities, and for waters used for recreational purposes are not officially established. In those waters only polyphosphates are subject to MAC (3.5 mg/l for polyphosphates, and 1.1 mg/l for phosphorus).

The goal of our study was to determine phosphorus content and concentrations of biogenic elements in surface waters of water objects in Leningrad Region. We identified phosphate content by using the colorimetric method. The method is based on the interaction of orthophosphates with ammonium molybdate in acidic environment. The resulting compound is heteropolyacid of molybdenum-phosphoric acid,  $H_7[P(Mo_2O_7)6] \times nH_2O$ . Then it undergoes reduction reaction with the ascorbic acid in the presence of potassium antimonyltartrate. The result is intensely colored molybdenum blue. We used photocolorimeter KFK-2 for our analyses.

We analyzed 27 samples from water bodies: Blyudechko Lake-central parts and by the shore (samples No. 1, 2); Penaty Creek source and Mouth Repino Village (samples No. 3, 4); Gulf of Finland- stream across from the hotel «Repino», at a boarding house «Vostok-6» and by the dam (samples No.5, No.6, No.7); Storozhilovka River: middle flow and mouth (samples No. 8, 9)Sredneye Suzdalskoye Lake 30 m off the shore (sample No.10), Nizhneye Suzdalskoye Lake central parts and by the shore (samples No. 11,12); Malaya Sestra River middle flow, a mouth, at bypass channel and beyond bypass channel (samples No.No.13, 14, 15, 16); Bypass channel below the dam (sample No. 17) Privetnaya River: by the bridge and middle flow (samples No.18, No.19); Smolyachkov Creek mouth, upstream from the water treatment plant and by the bridge (samples No. 20, 21, 22); Black River: by the bridge,: middle flow, upstream from the lighthouse and beyond the "Ocean"(samples No.No. 23, 24, 25, 26); Pridorozhnoye Lake by the shore (sample No. 27).

Computed results were compared with the value of MPC = 0.2 mg/l (for waters used for fisheries). Our data suggest that majority of water bodies in our study contained phosphates in concentrations below MPC. In two samples, nutrient concentrations were double the MAC-values. This result implied organic contamination of water bodies. The study was performed at the 54<sup>th</sup> Inter-Regional Environmental Bios School (August 2012) organized by the Inter-Regional Environmental Club for graduate students, college students and school students of the Baltic-Ladoga region.

V.I. Lebedev M.F. Lebedeva N.I. Lebedev

#### GEOECOLOGY OF EXPLORATION OF MINERAL RESOURCES OF THE REPUBLIC OF TYVA

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Under discussion there are problems of geoecology of commercial exploration of mineral resources in the Republic of Tyva. A role of geological processes causing disturbance of natural balance and geochemical cycles, influence of a distribution density, natural erosion, and technogenous disruption on objects, contained heavy and toxic geochemical elements, upon ways of their migration in environments have to be taken into account. A degree of geotechnological and ecological development of deposits for commercial exploration has been evaluated. Retrospective analysis and prediction of anthropogenical stress impacts, resulted from conducting geological works in ore fields of arsenide silver-cobalt, carbonanite, gold-ore, gold placer, rare-earth – rare metal, polymetallic, coal, and chrysotile-asbestos deposits, are given. Ecological advisability of utilization of wastes of "Tuvacobalt" and "Tuvaasbest" plants, Kaa-Khem and Chadan coal pits, and sand-clay refuse of prospector's gold extraction in 1856-1953 have been considered. Data on radioactive pollution of Tuva territory by erosion and prospecting of uranium deposits and nuclear tests at Semipalatinsk (East Kazakhstan) and Lobnor (North-West China) proving grounds have been presented.
The objects revealed in Tuva each contain a specific set of toxic elements. Maximum permissible concentrations in soils have been established for these elements: selenium – 0.05 ppm, mercury – 2, cadmium – 3.5, beryllium – 4, molybdenum – 4, antimony – 5, strontium – 10, arcenic – 20, boron – 30, cobalt – 30, chrome – 40, nickel – 50, copper – 60, vanadium – 60, zinc – 70, and lead – 100 ppm. Although the distribution of anomalous endogenic concentrations is of low density and total area of districts of elevated contents of environmentally dangerous components occupies no more than 0.0001 % of the Tuva territory, the availability of natural stream-forming sources and realms of their accumulation required special ecologo-geochemical studies.

In the course of study of mountainous zones and intermountain basins on the territory of Tuva and adjacent regions of Mongolia, a degree of landscape complexes pollution by heavy metals, toxic elements, and natural and artificial radionuclides has been evaluated. Contents of artificial radionuclides Cs-137 and Sr-90 in soils, forest falling off, and mosses have been determined. The stratifying of their high concentrations suggests that the territory was repeatedly polluted by radionuclides. The geochemical studies of natural complexes permit us to make a conclusion that the most of the Tuva territory is radiation undangerous for human habitat today. Some regularities of anomalous concentration of toxic elements in natural environments have been revealed. Association of anomalous contents of Hg to the basin complexes was most conspicuous. Mercury anomalies have been studied in details with collecting heavy concentrate samples of large volume. It is established that the elevated Hg concentrates in soils, formed upon prospector's working off planted by forest vegetation, follow regenerated gold-bearing placers which magnetite jets in the near-bedrock part of sand-clay refuse are enriched in products of amalgamation with fine and dispersed gold untrapped earlier. The similar feature of mercuric gold concentration in the lower, near bottom, part of the placer-forming dump of adit was established at Kyzyk-Chadr Au-Cu-Mo-porphyric deposit and for a regenerated pay dirt worked out by system of underground exploitation minings in the bed and lower terrace ridge of the Soruglug-Khem river basin. Technologies and technological complexes for recovery of products of amalgamation and free gold untrapped earlier from sand-clay refuse of old prospector's working off at minimum losses of useful components and compliance with international standard of environment protection have been elaborated in Tuvinian Institute for Exploration of Natural Resources.

More than 86 million cubic meters of removal rocks (chrysotile serpentinites) and wastes of asbestos enrichment were accumulated as a result of commercial exploration of richest chrysotile-asbestos loads of the Aktovrak deposit in the Alash-Khemchic interfluve. It is evident that imperfect extraction of chrysolite-asbestos from serpentinites and intense pollution of agricultural lands and basin complexes of the Khemchik river valley by technogenous wastes have serious environmental impacts. A geotechnology of environmentally safe complex hydro-acid processing of chysotile serpentinites and utilization of wastes of asbestos pneumatic enrichment with production of high value commodity products has been elaborated under direction of V.V. Velinskii. These products are ultra-pure silica gel (silica filler) and amorphous  ${\rm SiO}_2$  for production of fiber glass optics and automobile cord, periclase for lining of open-hearth and steel furnaces, medicine gypsum, unsorted microasbestos for production of superlight heat resistant composite materials, and sulfide-chromite-magnetite concentrate contained elements of platinum group. Technologies for production of magnesium binder being almost as good as Portland cement in quality for use in one-story construction were elaborated at the Institute.

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### COBALT MINERALIZATION OF TUVA, ALTAI SEI AND NW MONGOLIA

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The area of cobalt mineralization in Tuva, Alta SEi and NW Mongolia is a part of the Altai-Sayan cobalt-bearing province [1-3]. There are different types of Co-mineralization: Ni-Co-As (Khovu-Aksy, Askhatin-gol, and Kyzyl-Oyuk deposits), Cu-Co-As (Uzun-Oy, Chergak and Mogenburen deposits), Co-As skarn (Vladimirovskoye), Cu-Co-W (Karakul), etc. The Co-As and Cu-Co-W major mineralization types of Middle Paleozoic age in that area are spatially and temporally associated with granitoids of the Yustid complex [2, 3]. There are also deposits of Permian-Triassic Ni-Co-As mineralization. The Karakul deposit is a typical Cu-Co-W mineral locality, and the Askhatin-gol deposit represents Ni-Co-As mineralization [3].

The Munguntaiga submeridional silver-bismut ore zone extends for more than 20 km. Its northern part contains the Askhatin-gol Ni-Co-As deposit, its southern part contains Ag-Sb mineralization. From north to south, Ni-Co-arsenide mineralization is replaced by Ag-antimony (at Pravoberezhnoye deposit), and, farther to the south, siderite-chalcopyrite and ore-free siderite veins (at Middle Naringol deposit). The Askhatin-gol deposit is located at the eastern flank of the Delyuno-Yustid basin, in relation to the Kurai-Kobdin deep fault zone that separates the Middle-Upper Devonian carbonate-volcanogenic deposits and the Cambrian volcanogenic-sedimentary rocks. The Cambrian rocks are intruded by Late Devonian-Early Carboniferous mafic rocks and Early Devonian plagiogranites of the Torgalyk complex. The Devonian rocks are intruded by biotite and two-mica granites and dikes of Yustid granite-porphyry and aplite (D<sub>2</sub>-C<sub>1</sub>) and younger dolerite. The granites are surrounded by hornfels, greisens, and skarned carbonates hosting veinlet-impregnated mineralization: Mo-W (molybdenite-scheelite) and Fe (pyrite-pyrrhotite). The molybdenite mineralization is related to greisens, the scheelite-molybdenite mineralization to skarned rocks, and the pyrite-pyrrhotite mineralization to hornfels and greisens. The dolerite dikes of supposedly Permian-Triassic age cross the skarned rocks.

The quartz-carbonate-arsenide mineralization fills the funnel-like echeloned system of fractures dipping towards the central part of the ore field. The carbonates and arsenic minerals fill pipe-like veins and fracture zones formed at the junction of S-N- and E-Wstriking faults. The carbonate veins cross the S-N- and E-W-striking faults, skarns, greisens and graphite-bearing hornfels. The arsenic mineralization is located in the intervals between the crossing veins. The veins, 0.1-3.5 m thick and 50-150 m long, are characterized by a flattened lens-like shape and uneven stepped selvages. The carbonate-arsenide veins consist of quartz, ankerite, siderite, calcite and subordinate barite and fluorite. The ore minerals are arsenides (Iullingite, safflorite, skutterudite, and rammelsbergite), sulfoarsenides (arsenopyrite, glaucodot, and gersdorffite), sulfosalts (tetrahehedrite, tennantite, and enargite), sulfides, and native Bi, As and Ag. The ores contain large dendritic crystals of native Bi.

Mesozoic hydrothermal mineralization occurs as Ni-Co-As (-250 Ma), Ag-Sb (240 Ma, Ar-Ar), Au-Ag-Hg (234.4 Ma, Ar-Ar) and Sb-Hg (231 Ma, Ar-Ar) deposits. Thus, the sequence of formation of Mesozoic mineralization in the Yustid ore node is: Ni-Co-As  $\Box$  Ag-Sb  $\Box$  Sb-Hg. Arsenide Ni-Co mineralization is the youngest and is separated from Ag-Sb and Sb-Hg mineralization by lamprophyre dikes (minettes, kersantites) Ag-Sb and Sb-Hg mineralization explicitly overlies lamprophyre dikes that can be observed at the Asgat deposit.

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#### GEOECOLOGICAL ASPECTS OF EXPLORATION OF MINERAL RESOURCES OF THE ULUG-KHEM RIVER BASIN (TUVA)

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Under discussion there are problems of geoecology of commercial exploration of mineral resources in basins of the Ulug-Khem river and its tributaries Bii-Khem and Kaa-Khem on the territory of Tuva. An influence of natural erosion and technogenous disruption on objects, contained heavy and toxic geochemical elements, has to be taken into account. Retrospective analysis and prediction of anthropogenical stress impacts, resulted from conducting of geological works in ore fields of Ag-Bi-Cu-Ni-Co-As, carbonanite, gold-ore, gold placer, rare-earth – rare metal, polymetallic, coal, and chrysotile-asbestos deposits, are given. Ecological advisability of utilization of wastes of "Tuvacobalt" and "Tuvaasbest" plants and sand-clay refuse of prospector's gold extraction have been considered. Data on radioactive pollution of Tuva territory have been presented. The objects revealed in Tuva each contain a specific set of toxic elements. Although the distribution of anomalous endogenic concentrations is of low density and total area of districts of elevated contents of environmentally dangerous components occupies no more than 0.0001 % of the Tuva territory, the availability of natural stream-

forming sources and realms of their accumulation required special ecologo-geochemical studies.

It is well known that Cd, As, Hg, Be, Pb, and Cr are most hazardous for the human habitat. Solis, proluvial-alluvial deposits, and rocks in most of ore regions of Tuva are enriched in these toxic elements. The Ulugoi ore cluster is a source of Cd, S, and Pb. The Khovu-Aksy, Ulatai-Choza, Chergak, Kyzyl-Oyuk, and Askhatiingol ore fields are sources of As, Sb, Cu, Co, and Ni. The rare-metal and lithium-fluorine deposits of the Sangilen supply Be, B, F, and natural radionuclides U and Th. The chromite-bearing ultrabasic rocks of the Kurtushibinskii, Agardag, Kaa-Khem ophiolite belts are sources of Cr and V. The barite-cinnabar ores of the Terlig-Khaya, Arzak, and Chazadyr deposits, mercuric gold of quartz-veined, sulfosalt-sulfide, and copper-molybdemun-porphyric deposits, and products of amalgamation in wastes of sand-clay refuse of prospector's gold mining accumulated from 1856 to date are main sources of Hg in environments of basin complexes of the Ulig-Khem, Bii-Khem, and Kaa-Khem rivers and their tributaries.

In the course of study of mountainous zones and intermountain basins on the territory of Tuva and adjacent regions of Mongolia, a degree of landscape complexes pollution by heavy metals, toxic elements, and natural and artificial radionuclides has been evaluated. Contents of artificial radionuclides Cs-137 and Sr-90 in soils, forest falling off, and mosses have been determined. The stratifying of their high concentrations suggests that the territory was repeatedly polluted by radionuclides. The geochemical studies of natural complexes permit us to make a conclusion that the most of the Tuva territory is radiation undangerous for human habitat today. Some regularities of anomalous concentration of toxic elements in natural environments have been revealed. Association of anomalous contents of Hg to the basin complexes was most conspicuous. Mercury anomalies have been studied in details with collecting heavy concentrate samples of large volume. It is established that the elevated Hg concentrates in soils, formed upon prospector's working off planted by forest vegetation, follow regenerated gold-bearing placers which magnetite jets in the near-bedrock part of sand-clay refuse are enriched in products of amalgamation with fine and dispersed gold untrapped earlier. The similar feature of mercuric gold concentration in the lower, near bottom, part of the placer-forming dump of adit was established at Kyzyk-Chadr Au-Cu-Mo-porphyric deposit and for a regenerated pay dirt worked out by system of underground exploitation minings in the bed and lower terrace ridge of the Soruglug-Khem river basin. Technologies and technological complexes for recovery of products of amalgamation and free gold untrapped earlier from sand-clay refuse of old prospector's working off at minimum losses of useful components and compliance with international standard of environment protection have been elaborated in Tuvinian Institute for Exploration of Natural Resources.

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# ORIGIN AND DEVELOPMENT OF THE TUVINO-MONGOLIAN MASSIF

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Tuvino-Mongolian massif is held to be one of largest massifs in a structure of the Central Asian Mobile Belt fringing the Siberian Platform on the south and south-west. Such massifs with the crystalline basement are considered as microcontinents – fragments of continental massifs, included in the supercontinent Rodinia and attached to structures of surroundings of the Siberian Platform in the course of the Paleoasian ocean development. New information on development of endogenous processes in the Tuvino-Mongolian massif has been obtained from recent investigations. Features of geological setting of metamorphic complexes (Naryn, Moren, and Erzin complexes) have been studied. The Naryn complex is made of essential carbonate, terrigenous-carbonate, and terrigenous piles of the Balygtygkhem, Chartys, Naryn, and Chinchilig formations. These rocks are attributed to deposits of epicontinental shelf seas. The Moren complex includes volcanic and sedimentary rocks metamorphosed in the conditions of the amphibolite facies and formed in the environment of rifting structures of passive continental margins. The Erzin complex is made of biotite and garnetbiotite gneisses, intense migmatitized, with relicts of the granulitic facies. Their protoliths were sedimentary rocks typical of basins of passive continental margins. Hypersthene and bipyroxene crystalline schists of the Lower Erzin tectonic plate are attributed to the Erzin complex too. The initial rocks of the schists can be considered as fragments of paleoisland-arc and paleoocean formations. U-Pb dates (SHRIMP) of detrital zircons from metaterrigenous rocks of the Moren complex are 750 m.y. and of the Erzin complex – 800 and 900 m.y. This determines a lower age boundary of rocks accumulation.

Under study there were features of geological setting of intrusions, located within the Tuvino-Mongolian massif, and granitoids of the Tannu-Ola intrusive complex of the East-Tannu-Ola and Kaa-Khem zones of the massif Caledonian surroundings. Age of these formations have been estimated by U-Pb dates of zircons (SHRIMP). The crystalline complexes, formed in the course of the Archean and Early Proterozoic tectogenesis within the Tuvino-Mongolian massif, have nit been found. The results of geological-geochronological investigations permits us to recognize steps of formation of the Tuvino-Mongolian massif and to establish a nature of this structure which determines main features of structure of the Early Caledonides of the Central Asia. The Tuvino-Mongolian massif can not be considered as a craton fragment. It formed as a result of tectonic conjugation of metamorphites of lower grades with non-metamorphised shelf rock piles in the range of 496.6 3.5 – 521 12

m.y. An age of formation of mapped main structures has been estimated at 496.9 3.5 m.y. An interval when thrusts, associated with placing of granulites into the upper structural layers, were formed has been determined as 489.4 2.6 – 480 5.4 m.y. The latter value notes completion of high-grade metamorphism and folding. By the 464.6 5.7 m.y. the Tuvino-Mongolian massif has been separated as a rigid stable structure. The intense deformations in the surroundings are manifested themselves as intrusion of tonalites of the Tannu-Ola complex in the Kaa-Khem and East-Tannu-Ola zones of 451 5.7 and 457 2.9 m.y. old. The formation of the Tuvino-Mongolian massif as a whole was associated with accretionary processes in the course of Paleoasian ocean closure. As this took place, fragments of piles, initially separated, were tectonically conjugated and then "soldered together" in the course of high-grade regional metamorphism occurred at the deep sections of this heterogeneous structure .

On the territory of the Tuvino-Mongolian massif, the subsequent geological events were determined by processes of intraplate magmatic activity. They are related to development of hot field of the mantle in the basement of the southwestern surroundings of the Siberian Platform, a constituent of the North-American superplume. The indicators of intraplate magmatic activity in the region are formation of subalkaline and alkaline gabbroid massifs (Korgerebadan and Harlin massifs), alkaline granites and syenites (Ulug-Tanzek, Koktyg-Khem, and Terben), lithium-fluorine granites and pegmatites (Solbeldyr and Tastyg), nephelie syenites (Bayan-Kol), and others.

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### ISOTOPIC-HELIUM RATIOS OF THERMAL FLUIDS FOR ESTIMATION OF TECTONO-MAGMATIC ACTIVITY IN EAST TUVA

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A heat flow is one of the most important characteristics of physical state of the lithosphere. Additional parameter characteristics of its temperature field enhance the understanding of tectono-magmatic processes associated with plume tectonics and deep geodynamics. Recent evidence on evolution of volcanism of East-Tuvinskoe Lava Highland, a part of the Late Cenozoic South-Baikal volcanic area, permit us to define the region under consideration as tectonically and magmatically active, volcanically dangerous, and with high probability of new eruptions. The parameter evaluation of tectono-magmatic activity in East Tuva is impossible without instrumental study of the

### Programm Abstracts

heat field and estimation of a thermal state of this segment of the lithosphere.

Geothermal studies in Tuva were conducted by researchers of Institute of Geology and Geophysics, Siberian Branch of the USSR AS (Novosibirsk), and Tuvinian Complex Department, Siberian Branch of the USSR AS (Kyzyl), in 1970-1990. Heat-flow measurements were carries out in boreholes sited mainly in Central Tuva. In East Tuva, there are no boreholes feasible for heat-flow measurements. Hence, currently available methods of gas geochemistry were used for heat flow estimation. Samples have been collected in numerous chambers of thermomineral discharge in eastern and southeastern Tuva and then analyzed. In 2003, five chambers of present-day thermomineral discharge, confined to active faults in the edge part of Bilin-Busiingol rift and its mountain surroundings, were sampled. The samples were collected from numerous hot springs in the central part of the rift (in the region of Ush-Beldir seasonal health resort); thermal springs of Emi-Busiingol zone (Tarysa); springs of Saldam confined to a zone of conjugation of Agardag and Busiingol faults; springs of Maimalysh in the middle part of the Academician Obruchev ridge; and a hydrosulphuric spring in the western part of the Sangilen uplift. According to data of mineral water zonation, four of sampled springs (Ush-Beldir, Tarys, Saldam, and Maimalysh) are situated within Khubsugul region of nitric springs and Naryn spring is located within Central-Tuvinian region of hydrosulphuric springs.

When the values of isotopic-helium ratios in samples from Busiingol hollow are compared with that of other intermountain basins of South Siberia, it is apparent that these ratios are similar to data on the Bargusin basin, little more than values for Baikal basin, far exceed values for Chara and Tsino-Bauntov basins, significantly below (in order) values for Tunkin basin, and somewhat below values for Khubsugul basin. The isotopichelium ratios do not decrease to the west of the Busiingol rift, as in the Baikal rifting zone, but are equal to values for springs, located within the basin, or increase in order. This suggests that the southwest flank of the Busiingol rifting zone is not limited by the Busiingol graben.

The elevated contents of total helium in gas samples are consistent with reduced isotopic-helium ratios (thermal springs of Tarys). The relationships between total helium and isotopic-helium ratio in other objects are not clear. The share of the mantle helium varies from 3.9 to 4.8 % in springs of the Busiingol basin and attains 11.2 % in the Maimalysh spring. This points to elevated heat flow in a latitudinal structure controlled location of Holocene fissure eruptions, formed the Kaa-Khem valley lava river.

Hence it has been established that isotopic-helium ratios in the Bilin-Busiingol rifting structure and Baikal rifting zone were characterized by close values and stand out above the background value for continental crust formed in the Paleozoic. Consequently, following new data obtained in the course of investigations.

Calculated values of the heat flow in thermal chambers of East Tuva were first obtained based on evaluation of isotopic-helium ratios. The heat flow values for samples, spatially separated, vary from 66 to 68 mWt/m<sup>2</sup> and attain 76 mWt/m<sup>2</sup> in the Maimalysh thermal chamber.

The heat flow values can be related to the regional heat flow in the Baikal rifting zone in intensity. The insignificant decrease of hear flow intensity at the south continuation of the Busiingol rifting structure points to a high probability of its continuation on the south.

In spite of widespread occurrence of Cenozoic volcanic products in East Tuva, the relative low concentrations of mantle helium (3.9-4.8 %) in thermal springs can be circumstantial evidence of the initial step of the rift opening.

The high isotopic-helium ratios in samples of the Maimalysh thermal chamber, among wide occurrence of Holocene volcanism products, suggest that tectono-thermal (and probably magmatic) activation of the southwestern flank of the Baikal rifting zone is not limited by the transform structure of the Busilingol rifting graben.

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### ECOLOGICAL ANALYSIS OF SOIL CONTAMINATION BY NITROGEN-CONTAINING COMPOUNDS AND HEAVY METALS WITHIN THE PROTECTED NATURAL AREA NEAR BIG CITY

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The protected natural area Kumysnaya Polyana covers 4417 ha of the Bald Mountain plateau adjacent to the city of Saratov. Historically, Kumysnaya Polyana was of great importance to the city residents as the most popular site used for recreational purposes. It also acts as a source of fresh air for the city and hosts substantial biological diversity. Ecological and geographical importance of this forest is difficult to overestimate because it belongs to the category of intrazonal forests which survived on the spurs of the southern part of highlands near the Volga River. This allows a large number of forest species of plants and animals penetrate far deeper into the steppe zone, thus providing much greater biodiversity in the region as a whole.

Unfortunately, the proximity of this forest to Saratov, besides bringing benefits to the residents of the state capital, is a significant threat to ecosystems of Kumysnaya Polyana. The negative factors are both direct human influence (illegal logging, construction, forest fires, collecting rare plants, etc.) and indirect impact such as contamination of ecosystems of the natural area by various man-made pollutants emitted into the environment by industry and transport. Contaminants have ability for a long-term accumulation in the ecosystem, and soil is one of the places of their accumulation.

In this publication, an attempt is made to assess how proximity to the city limits affects levels of soil contamination within the protected natural area. For our study, we chose the

following pollutants: nitrates and nitrites of anthropogenic origin along with the cations of ammonium and heavy metals (cadmium, lead and copper). We divided the territory of the protected natural area into three zones: adjacent (close proximity to the city), medium and remote (farthest from the city boundaries).

The protected natural area Kumysnaya Polyana is divided into 134 forest-management sections. All sections are marked with numbered posts. To ensure random sampling procedure in our study, all section numbers of each zone have been entered in the computer, and the computer program generating a series of random numbers selected for us eight sections in each of the three zones to be studied for soil contamination.

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Zone / Concentration, mg in a kg of soil	рН	NO <sub>3</sub> -	NO <sub>2</sub> -	$\mathrm{NH}_4^+$	$\operatorname{Cd}_{2^{+}}$	Pb <sub>2</sub> *	Cu <sub>2</sub> *
Adjacent	7,11 ± 0,11	10,64 ± 2,58	0,16 ± 0,011	13,81 ± 0,45	0,0216 ± 0,0088	3,55 ± 0,41	0,0491 ± 0,0138
Medium	7,18 ± 0,07	1,91 ± 0,32	0,07 ± 0,011	11,85 ± 0,50	0,0008 ± 0,0001	1,43 ± 0,09	0,0026 ± 0,0003
Remote	7,27 ± 0,13	0,49 ± 0,06	0,03 ± 0,004	10,97 ± 0,36	0,0006 ± 0,0002	0,52 ± 0,07	$0,0008 \pm 0,0001$

Table 1. Soil acidity and average concentrations of soil pollutants within protected natural area Kumysnaya Polyana depending on proximity to the city limits.

For each sampled forest section, we took five 200 cm<sup>3</sup>soil samples at random locations, carefully mixed them, and then conducted quantitative chemical analyses based on standard techniques [Zolotov, 1999; Otto, 2003; Scholz, 2006]. This way we obtained the results for each contaminant at each selected forest section. Then the results of analyses on each substance were averaged for each zone (table 1). Statistical processing of data, including calculation of the standard error of the mean, and ANOVA analysis (one-way ANOVA) was carried out using the software package MINITAB [MINITAB ®, 2010]. The results are presented in table 2.

Table 2. Statistical significance of differences in soil acidity and average concentrations of pollutants among three zones within protected natural area Kumysnaya Polyana.

Soil acidity / Pollutants	pН	NO <sub>3</sub> -	NO <sub>2</sub> -	$\mathrm{NH}_4^{+}$	$\operatorname{Cd}_{2}^{+}$	$Pb_2^*$	$\operatorname{Cu}_{2}^{+}$
P (one-way ANOVA)	0,599	<0,001	<0,001	0,001	0,011	<0,001	<0,001

The study confirmed with high statistical confidence that the largest concentrations of all contaminants in the soil were found in the zone adjacent to the city while the lowest concentrations were detected in the remote zone. This finding supported our hypothesis that the pollutants were of anthropogenic origin, and the city was the main source of pollution of adjacent territories including the protected natural area Kumysnaya Polyana.

Natural cycles of nitrification and denitrification of organic matter in soils would account for approximately equal concentrations of nitrates and nitrites in all three zones.

That is why higher content of nitrates and nitrites in soils adjacent to the city limits can be attributed to exhaust gases from vehicles. These gases contain various oxides of nitrogen. Mixed with water vapors in the air and with rain water, they would provide precipitation of extra nitrites and nitrates into the soils.

Possible sources of heavy metals in soils of the protected natural area are the products of wear of motor vehicle tires. Tire material contains some zinc oxide (up to 2%), cadmium, copper and lead. Moreover, cadmium is present even in the products of combustion of unleaded gasoline. Besides, some additional cadmium in soils of Kumysnaya Polyana could be coming from the manufacturing shops of the alkaline nickel-cadmium batteries factory located in Zavodskoy District of Saratov.

In the past, significant amount of lead in soils of the protected natural area was most definitely coming from motor vehicle emissions burning leaded gasoline with tetraethyl lead. However, after the ban on production of this fuel in Russia in 2003, this source of lead in soils has become virtually non-existent. At present, the major source of lead in soils of the natural area can be attributed to the lead batteries plant («Elektroistochnik») located in Frunzensky District of Saratov.

Copper cations come to soils of the protected natural area Kumysnaya Polyana from multiple sources.

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### ENVIRONMENTAL ASPECTS IN THE ESTIMATION OF COMPETITIVENESS OF TERRITORIAL ECONOMIC SYSTEMS

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Competitiveness of territorial economic systems is regarded as efficiency in the use of regional resources, primarily workforce and capital, and is defined as an ability to create and maintain such an environment that attracts investment and talented workforce, enables business development and prosperity among population. Such factors as presence of resources, investments in technology, quality of business environment, infrastructure and others determine the competitiveness of territorial economic systems. At present, environmental factors obtain more and more significance. A high quality of environment and a developed system of environmental management ensure the competitiveness over different channels. For example, efficiency in the energy use leads to a cost reduction and increases the productive capacity of economy; good quality of the environment creates prerequisites for the effective use of workforce. On the other hand, a change of the environment for the worse leads to extra expenses for the workforce, degradation of certain economic sectors, in particular, agriculture etc. The territories which follow a strict policy of environmental regulation, on the one hand, will be less attractive for investors,

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because the latter will have to put in additional investment to guarantee the observance of environmental standards. On the other hand, they will be more attractive for people. The most important factors for attracting people are natural factors, infrastructure (living conditions, education opportunities, etc.), economic factors (level of employment and payment) and the state of environment (air, water quality, etc.). They all determine the incorporation of environmental factors and the territorial policy in the area of environment into the assessment of the competitiveness level of various territorial economic systems.

The analysis of different assessment methods of competitiveness of territories (countries, separate regions of countries, municipal districts) has shown that environmental factors are not always paid due attention. For example, "Global Competitiveness Report" (WEF) lists more than a hundred criteria, and not a single one of them is connected to environment. "World Competitiveness Yearbook"(IMD) includes the state of environment into the assessment of the national competitiveness - e.g., use of water, energy, emissions, climate change and implementation of environmental innovations. However, altogether they only comprise 7% from 331 criteria. Annual "European Competitiveness level, which is influenced by worsening of problems not connected to environment. At the same time, "Europe 2020 Competitiveness Report" puts environmental factors into a separate group of parameters which guarantee sustainable development of European countries.

Certain environmental factors, however, can be found in the competitiveness assessment of certain regions of countries. Regular ranking scores of competitiveness level that are created for different U.S. states and cities include 3 environmental factors. A great number of methods for competitiveness assessment of regions and municipal units that are suggested in the Russian Federation are based on various factors which, according to their authors, have a significant influence on competitiveness. However, only a limited number of these methods take into account environmental factors.

If we take into consideration the fact that environmental protection is one of the key factors for economic development and prosperity, the necessity to include this factor into the competitiveness assessment of territorial economic systems becomes obvious.

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Tube furnaces are widely used in the chemical industry. At many plants still operating furnace, designed and built over 30 years ago, with a high margin of safety. Therefore, this equipment is more appropriate to upgrade, not to re-design.

We were the first on the basis of optimizing the design of the furnace convection type, found a correlation between the parameters of the furnace, design changes, and the number

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of edges of the coil. A series of calculations to determine the effects of reducing the surface of the fins and the possible ways to compensate for changes in operating parameters. The data on the minimum area of the fins, which provides the necessary heat transfer. Optimal parameters were obtained through a series of calculations performed by varying: excess air, fuel and pollution inside of the pipes coke.

Current rating coke deposits, as a measure of optimization tube furnace is not in doubt. We have proposed a method to control coke formation, developed computational method, based on the correlations between the thickness of coke deposits and temperature to the coil, offered the option of upgrading the design tube furnace by installing thermocouples, placing them on the walls of the pipe coil.

More efficient source of energy is by far the gas fuel. To compare the characteristics of the furnace, while working on a different type of fuel, the furnace was calculated P-1 installation L-35/11 shop No. 18 JSC "APC" on oil-fired and gas-fired by the regulatory method. It is shown that the transfer tube furnaces to natural gas will improve the technical and economic indicators of production. Gas fuel is easier to mix with air, so to achieve more complete combustion, compared with fuel oil, it is technically easier. The maximum temperature of the flue gases from the combustion of gas will be more, the combustion of fuel oil, but due to the smaller total number of flue gases will be reduced, respectively, to increase efficiency of the furnace. Therefore, under the constant need to upgrade production facilities and use the most energy efficient, using as an energy costand energy-intensive gas, can improve the performance of power plants

The investigations allow the development of measures to improve the technological parameters of the tube furnace, reduce risks and limitations associated with their use. The results can be used to design materials of modernization and reconstruction of enterprises.

V.A. Makina

### ASPECTS OF ECOLOGICAL EDUCATION AND UPBRINGING IN A HIGHER EDUCATIONAL ESTABLISHMENT

Non-State Educational Establishment Higher Professional Education "Essentuky Institute of Management, Business and Law", Essentuky

A man as a part of biosphere subordinates to its laws and at the same time estranges from the nature, and this is the consequence of global ecological crisis. Nowadays many people consider the solution of ecological problems as not their personal concern but as the business of the state. Man's ideology determines his or her behavior, that's why ecological threat should be conscious by people. The barest necessity of formation new ecological outlook arouses.

Ecological ideology is becoming a mechanism of safety and adjustment in human and society survive on Earth and country and region scale.

Providing of ecological security of Russia as a condition of state survive presupposes the changing of current privileges into ecological ones in all dimensions of state policy. That is impossible to do without corresponding changes of human conscious, and valuable system in society in whole, and essence comprehension of ecological problems and participation of every person in their solution.

Famous scientific and ecologist N.N. Moiseyev wrote that ecology begins from ideology, nowadays ideology begins from ecology and ecological thinking, and human education and upbringing from ecological upbringing.

It is significant that every region has its own specific character, provided by natural and climate conditions, social and national composition of population, traditions of developing natural resources, kinds of economic activity, level of development of educational system etc. "Essentuky Institute of Management, Business and Law" is located in town-resort Essentuky. This town is situated in territory of special conservation ecological spa region of the Russian Federation – that is Caucasian Mineral Waters. The region is a unique territory and is located in mountainous sanitary-security zone which is a unique mineral waters deposit of Caucasian Mineral Waters of Caucasian Mineral Waters, for providing efficient using of therapeutic and sanative factors, balancing solution of security problems of environment, natural resources potential of territory, its social-economic development for the sake of the state.

The experience of theoretical and practical realization of different methods of ecology education was accumulated in Essentuky Institute of Management, Business and Law.

Scientists of the Institute worked out and introduced the system of ecological education and upbringing. This system is characterized by complex, interdisciplinary, ecological education continuity, formation of modern science view. During the training contemporary specialists in our Establishment in every specialty and direction such disciplines as Ecology, Vital Activity Safety, Ecological Management are given, just as ecological problems are examined in every common and special discipline obligatory.

The characteristic feature of ecological education in our Establishment is its connection with research activity. Ecological themes exist in course projects, graduated qualification works. The students and young scientists introduce their results of their research in scientific practical conferences, symposiums, seminars. The most important aspect of ecological education in our Institute is scientific advocacy the fact of ecological laws concern substantive and spiritual culture and influence on social processes. The guarding of nature by means of feedback returns to us in security of life and health of a person.

Nowadays the experimental area "Ecology of Our Town" is created, where the continuous ecological education system is clearly looked: family – school – college – higher educational establishment – population. Joint ecological actions, round-table discussions, ecological festivals, ecological competitions are held.

We realize that society and nature have the equal destiny and the future is dependent on our ecological culture. Nature security is the matter of conscience and obligation of every person and we realize this understanding throughout higher education and elucidative work, which relies on human and biosphere co-evolution directed to overcome negative patterns composed in society and formation of a person with high spiritual moral ecological competence.

V.V. Markhinin

### **ECOLOGICAL ETHICS AND SCIENCE**

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Ecological ethics is a historically new form of moral relationship whose genesis was due to the global ecological crisis. As a relatively self-defined form, ecological ethics emerged in the 1970s. The following two thinkers are mostfrequently considered as its founders: the German physician Albert Schweitzer (1875-1965) and the American ecologist Aldo Leopold (1887-1948). However, in our opinion at least one other person should be included as a founding father of ecological ethics: Vladimir Ivanovich Vernadsky (1863-1945), a Russian thinker, eminent scientist and the founder of the doctrine on the biogeosphere and noosphere.

Ecological ethics, being an aggregate of moral norms, is intended to regulate the relationships of humans and human societies with nature or, more specifically, with living beings at the super-organismal level (i.e. at the level of all kinds of communities, populations and types) in accordance with the conditions of their existence and reproduction, in that they are considered as ecosystems.

Obviously, the relationship of man with respect to nature has been regulated by moral norms, such a relationship is included among those that exist between people in regard to nature and natural objects. Therefore, any relationship among people will have a moral dimension. Consequently, it is appropriate to note that the novelty of the character of man's moral relationship toward nature, which has manifested itself in the emergency of ecological ethics, is derived from the fact that it has become a subject of special, theoretical research. In other words, we shall speak not about some new ethical discipline as an alternative to the "traditional" one because ethics in general can only be traditional or "eternal" and, in the context of ethics, the essence of man as an ancestral, eternal being is embodied. Instead, we refer to a historically new form of moral relationship of man with respect to nature, or about a new form of traditional ethics.

Ecological ethics has two main orientations. One of them consists of ecological ethics in direct contrast to traditional ethics, whereby one proclaims the former to be completely new and the logical replacement for the latter. Such a claim is justified by the fact that traditional ethics is charged with having neglected nature, thus being derived

(as asserted by the proponents of such orientation) from its anthropocentrism, which is the likely reason for the modern ecological crisis.

The other orientation presumes that ethics is necessarily human-centric, because the object of ethical relationships as well as all other relationships is humankind (people) but neither any other kind of living being or nonliving natural essence (i.e., an object or a thing). The moral relationship of man toward nature is a moral relationship among people in relation to nature, as conditions, media and means of their life and livelihood. The changes in the area of ethics are dependent upon the changes in the character of human interaction in relation to any matter, particularly in relation to nature (whether living or nonliving), touching only the form but not the essence of moral relationships. Thus, in this case ecological ethics is a way to update the moral relationship toward nature based on the development of ecology as a science, being intended to identify the real character of changes in the area of man's practical interactions with nature and to propose practical measures to overcome the global ecological crisis. Therefore, within the framework of this orientation the ecological ethics is capable of acting not only on a theoretical basis but also as a scientific discipline.

Based on the current progress in the study of ecological ethics, it conspicuously or inconspicuously shows the prevalence of a biocentric and/or nature-centric position, being proposed as an alternative to human-centric orientation. What, in particular, can be observed from the fact that generally only two figures--A. Schweitzer and O. Leopold--are considered the founding fathers of ecological ethics? The doctrine of A. Schweitzer, which is centered on the "ethics of awe before life," serves as the basis for biocentric orientation in ecological ethics. The doctrine of O. Leopold, however, declares the need for an inclusive, unified ethical community (he called it "earth" and referred to his particular doctrine as "earth's ethics") based upon the moral partnership of man, animals, aquatic life, soil and vegetation. We must ask what eventually served as the foundation for a wider, nature-centric orientation in ecological ethics.

Given the wider recognition of at least equal value and legitimacy of human-centric orientation, it would be very difficult to exclude the name of such a thinker and scientist as V. I. Vernadsky, who pioneered scientific research and the doctrine of the biogeosphere. The scientific, theoretical fundamentality of Vernadsky's doctrine supports the doctrine's applicability as a fundamental scientific basis for ecological ethics.

However, the positive content of all research in ecological ethics, which is in such high demand in the current era, shall be conducted in parallel with human-centric orientation, at the foundation of which the central position is occupied by the scientific doctrine of V. I. Vernadsky. K.A. Naumova V.E. Stepanov

### THE THEORY OF RADIATION-INDUCED THERMAL DOSIMETRY AND ITS APPLICATION TO MEASURE THE CALORIFIC VALUE OF THE FUEL COMPOSITIONS OF HYDROCARBON AND INDUSTRIAL WASTE

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The absorption of the substance of ionizing radiation (radiation) leads to the absorption of energy by matter in the form of thermal energy and a corresponding increase in temperature. For example, take one liter of water and give a dose of 1 Sv (1 Sievert effective dose equivalent) for one hour. An hour later, the water was equal to the dose of 1 Sv, and this dose corresponds to the absorbed dose of 1 Gr (Gray), which is equal to the energy in 1J/kg (joule per kilogram) in SI. The SI is equal to the energy in 1 J 4.38 calories of heat energy.

Thus, the absorption of radiation material is accompanied not only in the standard air ionization chamber dosimeter Geiger counter inside, and increasing temperature of the substance. Therefore, by measuring the temperature rise can be determined dose. This method can be used to determine the energy output of the nuclear burning in fast reactors radioactive waste.

On the other hand, for the nonequilibrium thermodynamic systems, in which the process of isolation and loss of heat (it's not just nuclear reactors, but any heating system from the boiler to the brick ovens), the focus can be moved to the phenomenon of temperature rise. Thus we are led to the introduction of thermal dose.

Suppose we have a heater (furnaces, boilers, etc.), consuming a variety of fuels (wood, coal, rubber, etc.). On a plate heater can put a container of water and heat, by measuring the temperature of water at regular intervals. Will schedule the time variation of water temperature in the heat. Postponing ordinate temperature and time on the horizontal axis, we get the graph of the process. The area under the curve on the graph is called a thermal dose and denoted S. The concept of thermal dose similar to the concept of the exposure dose, since the area of the heating curve is proportional to the amount of absorbed water, the amount of heat from the combustion of a certain mass of fuel (wood) in the hearth oven. In the International System of Units the thermal dose is in units of degrees (Celsius) in the second (deg  $\cdot$  s). For convenience, we introduce the data off-system unit dose temperature (deg  $\cdot$  min), and it is called Stephen, in honor of the great theorist - Thermo physics Josef Stefan, abbreviated denote St. It is evident that 1 St is 60 degrees per second (deg•sec).

For the measurement of calorific value were manufactured anti-radon ceramic gas generating furnace with a high efficiency (10 liters of boiling water for 13 minutes for heating dry larch). To determine the thermal dose form the basic equation of balance for the process of heating water by combustion of a fuel:

 $S = kHm \Lambda t$ (1)

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where S-the temperature-dose-furnace,k- heat transfer coefficient taking into account the loss of heat from flue gases, H-calorific fuel (mega joules per kilogram), m-fuel weight (kg), t-the total time of combustion of fuel.

From the basic balance equation for the temperature dose investigational find calorific value of coal 11.35 mega joules per kilogram (MJ\kg) mixture larch and coal 10.2 MJ\kg, plastic 37.2 MJ\kg, mixture larch and plastic 11MDzh\kg, rubber 25MJ\kg, mixture rubber and larch 12.2 MJ\kg, of waste motor oil 19.8 MJ\kg, mix oil and larch 10.9 MJ\kg.

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#### RAW MATERIALS AND PRODUCTION TECHNOLOGY **OF SILICON OF HIGH PURITY**

: Irkutsk State Technical University, Irkutsk

Silicon is widely used in various areas of industry. It is possible to single out two main directions of its use:

· High-technology production of silicon, semiconductors and solar grade silicon (chemical sector);

Production of aluminium-silicon alloys (metallurgical sector).

Silicon is obtained from silicon-containing raw materials by means of carbon reduction in ore-thermal furnaces at temperatures of about 2200 C. Melting of silicon in an orethermal furnace is a complex high-temperature process accompanied by various chemical reactions, with the formation of intermediary compounds. The silicon production process can be described by a single main reaction:

 $SiO_{2liquid} + 2C_{solid} = S_{iliquid} + 2CO$ The furnace charge for melting of silicon consists of quartz-containing raw material and a carbonaceous reductor, a mixture of carbon-based materials of different convergence production (petroleum coke, charcoal, coal, wood chips for opening).

In order to produce silicon, quartz and quartzites are used as quartz-containing raw materials. For example, the largest metallurgical grade silicon producing plant in Russia, CJSC "Kremniy" (UC RUSAL) uses the quartzite from Cheremshanka deposit, which has quite high chemical purity. Among reductors, costly and hard-to-get charcoal has the best reactivity, petroleum coke has the smallest ash content and coal has the best volatile content. A correctly selected proportion of carbon-based materials in the furnace charge allows achieving the best parameters of the technological process (silicon production, raw materials and electrical energy consumption) and a decrease in silicon losses due to waste gases.

We are conducting a series of research work to be able to use high-clean silica sands as ore material in future, which will allow us to make the most efficient use of the natural resources of Eastern Siberia.

However, the use of small fractional components during melting is not possible without the prior agglomeration of the furnace charge (e.g., by pelletizing, etc.). For this reason we

are developing a method of agglomeration of charge materials based on the production of a porous solid structure.

A source of impurity inclusions in quartz can be insufficiently reduced oxides (due to high sensitivity to oxygen) from reductor ashes. A part of oxides that are included into the process together with charge materials cannot be reduced during electrosmelting due to high sensitivity to oxygen. These oxides then form a slag phase, which gets entangled into silicon when it leaves the furnace. In order to carry out a thorough study of the chemical composition of these phase extrinsic compounds, we use a combination of various analyses (x-ray phase analysis, x-ray spectrum analysis, atomic absorption analysis, x-ray spectrum microanalysis and others).

This way, our research work is aimed at expanding the scope of use of mineral resources in Eastern Siberia during the study of high-purity silicon production technology by carbothermic reduction.

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### INTEGRATED ASSESSMENT OF POLLUTION IN THE URBAN TERRITORIES AND RISKS OF ITS IMPACT ON POPULATION HEALTH

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One of the main directions of ecological-hygienic monitoring is the knowledge gathering for risk assessment and analysis of connection of population health with habitation conditions.

Object of research: medical-hygienic monitoring with substantiation and selection of health disorders, related to environmental factors impact in various urbanized regions of RK. The researches have been conducted during 2010-2011 years on urbanized territories of 7 cities and 5 settlements in Kazakhstan. There were hygienic, clinical-functional, psychophysiological, biochemical and statistical methods used. Subject of research: soil, atmospheric air, tap water, acoustical and electromagnetic field, level of adults' health. During ranking of investigated territories polluted with separate toxicants, was revealed that soil pollution with content of cooper and cadmium considered as "moderate dangerous" in 1 city, soil pollution in other regions considered as "permissible". Relatively high pollution of atmospheric air revealed in 1 city and 2 settlements, and high pollution in 2 cities. Quality of drinking water didn't meet high requirements of hygienic regulations only in 2 cities. Level of water pollution with heavy metals for half population considered as "moderate polluted". Intensive indicators of total amount of diseases among adults (prevalence, number of new revealed diseases) had direct, strong significant correlation in airborne dust content of metals (r=0,8-0,6), that is not marked for elemental composition of drinking water. There are significant connections revealed between indicators, reflecting reduction of adaptive possibilities

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among adults with concentration of chemical agents in atmospheric air and content of metal in airborne dust. Probability of early changes in health among adults in urbanized territories is increased due to increasing of pollutants exceeding order with high statistical significance (p<0,0001), that can be realized in formation of concrete diseases, particularly upper respiratory tracts diseases. Number of diseases revealed during medical examination of adults, the indicators of laboratory and functional studies depended from levels of such factors, as content of suspended matters and gases in atmospheric air, metals in sediment dust and in soil, as well as noise. There list of somatic diseases was made for each studied region, on the basis of epidemiological, experimental and statistical studies, in occurrence of which revealed the impact of environmental factors, as well as distinguished diagnostic tests, sensitive to environment pollution. In order to achieve maximal climatic and hygienic comfort for habitation in the cities of Kazakhstan justified a new approach of integrated assessment of degree of medical-ecological situation intensity there developed preventive and managerial actions for fulfillment management on various levels (public, regional and local), aimed to rehabilitation and correction of early changes in population health.

V.V. Pechenkina

E LANDFILLING OR RECYCLING

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Landfilling occupied big plots of land in cities and towns. Landfilling occupied 52 hectares in the Krasnoyarsk region, 20 from them are in the Krasnoyarsk. The waste total volume amounts more than 11 million of tons in Krasnoyarsk. Municipal officials made a decision to build 7 landfilling in Krasnoyarsk during two years. It needs about \$ 2 million annually.

Recycling is alternative to build a landfilling. Only one recycling factory is operating in Krasnoyarsk, but it isn't used running at full capacity. In Sweden, only 1.4 % of the municipal solid waste (MSW) was landfilled in 2009 as compared to 39 % in 1994. While landfilling has decreased, recycling, incineration and biological treatment has increased significantly.

At present, there are more 30 world-known high temperature technologies in recycling waste, many of them are used successfully in the Germany, Japan, USA, Denmark etc. However, all of them can be divided to three groups depending on technical details.

The most typical representatives of first group are technology of «SBV» (Schwel-Brenn-Verfahren) from the «Siemens KWV». The Second group presented by not separated waste supplements pyrolysis technology (450-600°C) with gasification of solid remainders after pyrolysis. This group presented «Noell» (Germany) and «Thermoselect» (Italy, Shwitherland).

Third group include high temperature pyrolysis technologies which waste (separated or not separated) treated with temperature more 1000°C. The major in this group involve

Russian technologies, for example pyrolysis in melted slag of the Vanukov's furnace, plasma pyrolysis, «pyrolysis-gasification» of the Research Institution «Stromkomposit». Nowadays all waste recycling technologies are very expensive in Russia.

Sustainable development paradigm promotes minimal usage of scarce resources based on the resource-saving technologies, i.e. getting raw materials as a result of recycling processes. Germany pays close attention to the recycling of the building materials and constructions because construction and demolition wastes equals about 60% of all the country's wastes. Research results of Brandenburg Technic University scientists in Germany proved that concrete quality with recycled stone pearls is conformance to standard and is not worse quality than ordinary concrete.

Recycling is not extensively used in Russia because raw materials recycle costs are higher than the value of the raw materials. In addition, filling the landfills with the construction waste is much cheaper than the realization of the recycling process. In my opinion, solving waste recycling problem will be possible, when landfilling will cost more than wastes sorting and recycling.

Reducing waste is the way to limit and reduce volume of landfills and recycling. However, the total quantity of MSW per capita increased by 54 % in EU-15 from 1980 to 2005. With continuously increasing waste quantities, the total environmental impact of waste management risks to increase, both in terms of direct impacts from managing the waste and, even more, as indirect impacts from the production of all materials and goods that end up as waste. Several studies have shown that environmental benefits of waste prevention could be considerably larger than those of material recycling, biogas production and other ways energy recovery from waste.

To avoid increasing environmental and economic impacts, measures are needed for improving waste management efficiency and for waste prevention. This requires not only waste management but also production and consumption practices to develop in a sustainable direction. The instruments for a more sustainable waste management need integrated in a system on based the assessments of environmental, economic, cultural and social aspects of policy instruments.

Yana A. Philipson

### ECONOMIC AND ECOLOGICAL FEASIBILITY OF ENERGY EFFICIENCY IN BUILDINGS IN RUSSIA

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Over 80% of the Russian housing stock does not meet the modern standards of heat savings. The total amount of the Russian housing stock makes up 2.85 billion square meters (19 million residential building), 69.4% are privately owned, and 29.5% are in public and municipal ownership.

According to data of the Krasnoyarsk center for innovations and power efficiency, heat loss per square meter of the Russian housing is on the average 600 Gcal, and the total annual heat loss of heat power is equal to the annual capacity of one of the nine Russian nuclear power plants.

According to the analysis conducted by the group of Russian scientists under the leadership of Yu. A. Tabunshchikov, doctor of technical sciences, corresponding member of the Russian Academy of Architecture and Construction Sciences, with the conduction of complete overhaul of the building together with the resource saving measures, reduction of the specific consumption of thermal energy can reach 40-59% during the heating period. According to the conducted calculations, the cost of energy-saving measures by the example of the residential building with series II-18-01/12 has exceeded 14 million rubles, and the payback period has been more than 20 years, the profitability index for 30 years has been 1.85. Particular attention should be paid to the fact that during the period of complete overhaul of the residential building, reduction of carbon emissions during the period up to 30 years is more than 850 tons, reduction of carbon dioxide is more than 3250 tons.

According to the data of the Fund for assistance to the reformation of housing and communal services, just in 2012 the means of the total amount of 214.4 billion rubles have been allocated for the complete overhaul of apartment buildings that will make it possible to repair 134.9 thousand buildings with a total area of 400.6 million square meters, improving the living conditions of 17.4 million people. With a simple calculation it is possible to be certain that the funds allocated in this case for the repair of 1 square meter of the building do not exceed 800 rubles even with co-funding from the regional budget, that according to the calculations is not enough for the complex rise of power efficiency of the building.

Thus, the Russian Federation currently has a huge potential in the field of project implementation to improve the power efficiency of the buildings and the ecological situation in the world. One of the major factors is the lack of investment in this field. The example of the way out of the given situation is the special loan programs offered by the European banks or subsidies provided for the complete overhaul with the increase of power efficiency in the U.S.A.

For the developers one of the restrictions preventing the use of resource-saving technologies is the increase of the duration of the building permit obtainment and the rise of the costs of construction in this case. The whole set these factors increases the final value of the property that reduces its competitive qualities from the point of view of the majority of Russian people, only 15% of them can buy property, even with the help of mortgage, according to the public polls. In this case, an effective measure of the state is to reduce the time of endorsement and expertise of building projects with the increased power efficiency, as well as the private-state partnership in order to provide loans with low interest rates both for the construction companies making power-efficient buildings and for purchasers of such buildings.

The implementation of the following measures, in my opinion, will also increase the

number of power-efficient buildings on the territory of Russia:

- mechanisms of economic stimulation of the increase of the building power efficiency by the state;

- establishment of the market of professional management in the field of real estate;

- availability of the finished design solutions;

- stable economic and political situation, detailed elaboration of the regulatory and legal framework.

A.M. Plyusnin

# INFLUENCE OF MINING PRODUCTION WASTES ON ENVIRONMENT AND WAYS OF PROBLEM SOLUTION

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Due to vulnerability of technological processes that are used for extract of useful components, negative effect of the production on environment is inevitable. Annually, milliards of tons of solid, pasty, liquid and gaseous wastes of production get into biosphere, causing irreparable damage to wildlife and inanimate nature. Anyway, 90-95% rocks that are extracted from the depths in Russia transform into wastes that equal 120 milliards ton in absolute terms. Among them, more than 1 milliard toxic substances are sources of ecological tension. Every year the area that is occupied by wastes increases up to 250 thousand hectares. Ore tailings averagely contain 3-4% ore matter with contents of toxic elements: As, Cd, Hg, Se, Pb, Zn, F, etc. Tails in technological process are split and well permeable for atmospheric and surface water. As a result of storage under effect of ore weathering agents, ore matter is dissolved and carried out off-site storage by underground and surface water, polluting the surrounding areas. Toxic elements accumulate in exogenous minerals, soils. They are absorbed by vegetation, further migrate along the trophic path, and poison people. No more than 20% ore matter is extracted by modern technologies of tail recycling. In addition, there are problems with acid destruction of equipment, etc.

The Dzhida tungsten-molybdenum mining enterprise functioned for 73 years since 1934. Massifs of man-made sand occur in the area that attaches to the ore processing plants. Their total mass equals more than 40 millions of tons. Those formations appeared main sources of environmental contamination with heavy metals and other toxic chemical elements. Anomalous contents are revealed in surface and underground water, soils, vegetation. Stale sands are intensely transformed within the 4 meter near-surface layer. Sulfides are largely oxidized, zinc and cadmium carried out. Exogenous minerals are formed. In general, there is a tendency in increase of lead, copper and zinc mobile form contents in stale man-made sands on the background of decrease in their total contents. The most important changes are as follows: increase in proportion of ion-exchange forms of all studied metals; decrease in carbonate fractions of copper and zinc; significant increase

in fraction of copper associated with iron-manganese oxides; lead mostly occurs in hardly mobile organo-mineral complexes.

At present, technologies of environmental protection from pollution of mining production wastes being in tailings are based on isolation of wastes from precipitation, surface and underground water effects and generally from oxidizing conditions, and on concentration of pollutants from water run-offs followed by their return to the place of storage. Both approaches require continuous monitoring of insulation dams, monitoring of surface and underground water, etc., i.e. investment after completion of the company.

We consider the approach to the technology of mining production waste storage that is based on regulation of processes running in sand and their use for conservation of toxic substances to be more perspective. When using such method of waste storage, forms of toxic elements being mobile in exogenous conditions will be transformed into hardly mobile forms. Their binding to hardly mobile compounds can be realized at all stages of work with tails: during transport, accumulation and storage.

A.L. Podolsky S.V. Bobyrev E.I. Tikhomirova USE OF INFORMATION TECHNOLOGIES IN ENVIRONMENTAL MONITORING Saratov State Technical University, Saratov

Ecological monitoring as a means of obtaining information for decision-making in the field of environmental management may be regarded as a feedback component in the system of ecosystem management. In this system, we distinguish three management components: stabilizing, operational, and strategic.

The territory of the Saratov region is located within several biogeographic zones, hence the diversity of ecosystems in the region. Taking into account relatively arid climate of the region, the status of aquatic ecosystems requires special attention. Shore ecosystems provide barrier function to water bodies, therefore monitoring their status should be an integral part of the overall integrated environmental monitoring system of water bodies and coastal ecosystems. While developing effective methods of monitoring, it is also important to ensure the possibility of joint analysis of information obtained from various geographically distant sources. This requires specific organizational design, and software and hardware solutions, which is the goal of this work. Our studies on environmental monitoring of natural and anthropogenically affected ecosystems take the following standpoints into account: they are comprehensive, they cover large areas to reduce the effect of spatial heterogeneity on study results, and their methodology of monitoring projects must be well developed and consistent throughout the research period. This applies to protocols of sampling environmental variables, sampling techniques of animal and plant populations, to analysis of obtained data using multivariate statistical techniques, and to the IT and software used for data processing.

Data collection for monitoring studies, especially in the conditions of poor research budget, shortage of available research staff, unavailability of transportation to research areas, and vandalism towards equipment left in the field, can be tedious. Additionally, data processing, analysis, and mapping are very time-consuming. That is why we chose mobile solutions based on the principle of remote sensing and use of modern IT as main features for the newly developed system of integrated environmental monitoring of water bodies and coastal ecosystems (Fig. 3). We have successfully tested use of mobile stations for collecting primary information about the current state of ecosystems. These mobile stations were based on off-road vehicles and small boats (including recreational crafts equipped for moving on ice). Currently, use of model unmanned aerial vehicles is under development.

System of integrated environmental monitoring based on Web-technologies. Hardware used at mobile stations includes sensors connected to a laptop computer with wireless Internet access or mobile phone Internet access, and a GPS device. Sensors represent field instruments, such as pH-meter, thermometer, turbidimeter, oxygen sensor, voltammetric ion-selective electrodes, echo sounder for depth measurement, etc., for measuring environmental variables. We set those on mobile stations for measuring physical and chemical parameters of the water and surface air, and for identification of the riverbed topography. We currently explore possibilities of using mobile stations for field sampling of riverbed and floodplain soils, and evaluation of the ecological status of biological resources (aquatic and shore vegetation, fish and macro-zoobenthos resources, water bird communities, etc.) using available standard methods.

Incoming information is generated through a system of sensors that have an interface to connect to the laptop computer set on a mobile station. For sensors that do not have such interface, we developed the paring devices and relevant device drivers for the transmission of information. Using highly integrated elements for developing the hardware system made the system small and easily configurable. Sensors are connected to the computer by means of USB-2 or wireless interface. Collected data are transferred to the shared desktop server via Internet. These data are kept in a source-specific manner: It is easy to establish an authorship of different pieces of information and the algorithms used for its processing. This facilitates comparing various information sources in terms of reliability and geographical proximity. Some redundancy occurring in this scenario allows evaluating the reliability and consistency of the data. Data outliers from some sources do not mean that they are erroneous. Reliability of information can be checked by additional research conducted according to the algorithm specifically developed for this occasion.

Use of GIS technologies and available mapping software allows us to plot collected data on regional maps. This allows accomplishing the following tasks:

1. Creating a vector map of the region representing all water bodies in the region with high accuracy, using the ArcGIS-type software to address geographic information tasks and to present the solutions of these tasks in common formats;

2. Compiling the databases containing all important variables on the basis of the

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vector map along with the data obtained from other specialized organizations and in our own research;

3. Creating a knowledge base reflecting the patterns and relationships among the processes affecting the performance of water bodies on the basis of the hydrological regime dynamics studies;

4. Establishing an expert system producing practical recommendations on business solutions concerning rational water resource management in the region on the basis of the above knowledge base.

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### PECULIARITIES OF THE ENVIRONMENTAL MONITORING OF OLYMPIC FACILITIES IMERETI VALLEY AS OBJECTS OF ENGINEERING PROTECTION

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The report provides a brief description of the Imereti lowland, which is the object of building the Winter Olympics "Sochi 2014". Shows a complex geological and hydrogeological conditions. Summarizes the main activities of engineering protection of territory and the related changes in the environment. The necessity of the immediate organization of complex monitoring Imereti Valley.

Imereti lowland located on the southern slope of the Greater Caucasus mountain range between the rivers Mzymta and Psou (Adler district of Sochi, Krasnodar Territory), and has the largest undeveloped area almost the entire coast of the Black Sea. It stretches along the coast for about 8 km and extends deep into the coast to 0.8 - 2.0 km.

The east and west boundaries of Imereti are estuarine sections of rivers Mzymta and Psou. Plain surface slightly raised above sea level by an average of 1.5 m to 3 m, much of it swampy areas and are subject to flooding. Flooding of the territory is about 40% of the total, being mostly in the central part. Climatic features of depression are due to the heat of the Black Sea and the protective effect of the Greater Caucasus Range. The main features of the climate - hot, humid summers, warm winters, prolonged cool spring and warm autumn. The average annual rainfall at 1,500 mm, but in some years, falling more than 2000 mm.

Imereti lowland part of the territory with complex engineering-geological conditions. This is, first of all, the presence of significant power on distribution and thick lagoonal clay and peaty soils of plastic and viscous consistency. Wide distribution of wetlands and flooded areas. High seismic activity area.

Complex hydrogeological conditions aquifers are allocated in alluvial undallyuvialnyh and marine sediments of Quaternary and Neogene-Paleogene. Almost universal, and yearround presence perched.

A scheme Home Protection Imereti Valley from flooding:

1 - Scheme of artificial protection is dumping site elevation marks the surface to  $2.5~{\rm m}$  and -3.5 tab horizontal drainage.

2 - Stabilization of the water table in the existing elevations.

3 - Installation of storm sewer and construction of a new drainage system.

Work on the construction of the 1st phase of engineering protection Imereti lowland increased human impacts on the geological environment, which, in turn, caused activation of an engineering-geological processes.

Based on the scope of the study and the rank of the integrated monitoring Imereti lowland local level.

Integrated monitoring consists of the following key areas:

1. monitoring and consolidation of soil foundation engineering protection;

2. monitoring of ground and surface water;

3. monitoring of bank protection structures;

4. litomonitoring;

5. monitoring of the environment (air, soil, vegetation, animals, sound effects, background radiation, solid waste management, etc.).

Considerable amount of work, a relatively small area of construction, high intensity work, the use of a large number of mechanisms, building cars and trucks will inevitably have some negative impact on the ecosystem components Imereti lowland, and above all, on its biotic components that will continue to recover, but in the operation of facilities.

Environmental Monitoring System produced binding forecast changes in ecosystems and selected habitats in the area, which should be provided by the data of full-scale monitoring with  $\neg$  standing of the environment in the production of the engineering behind the shield  $\neg$  Imereti Lowland.

A.N. Rassokha A.N. Cherkashina

### ECOLOGICAL ASPECTS OF APPLYING FUNCTIONALLY MODIFIED POLYMER COMPOSITES IN CONSTRUCTION ENGINEERING

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Polymers and polymer-based composites have currently found wide application in various fields of construction engineering as construction, protection, adhesion systems etc. The major attention is paid to ecological safety of constructional polymer composites at all stages of the life-cycle (production, operation and reclamation) of products and structures made of these polymer materials.

In recent years, industrial and civil engineering have widely introduced so-called self-levelling floors, i.e. multi-component systems comprising a polymer matrix, functional

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additives, fillers etc. Self-levelling floors should meet high requirements as for their physical and mechanical properties (strength, wearability) and sanitary and toxicological characteristics (absence or minimum release of hazardous substances).

The article presents experimental data on the development and analysis of composite materials based on reactive oligomers (epoxy and furane-epoxy), functionally modified disperse fillers (silica sand), and modifying agents with high ecological safety.

The developed materials and technology of self-levelling floor formation from these polymer composites provide high ecological safety of the construction systems.

As chemical reactions in structurization of reactive oligomers with the use of a functionally modified filler are absolutely completed, this promotes creation of composites with minimum contents of low-molecular and oligomer components that are normally more toxic compared to high-molecular compounds.

This provides 3.5-4 times lower wearability of self-levelling floors in the course of their use thus decreasing dramatically the amount of indoor dust. The effective service life of self-levelling floors based on the developed functionally modified polymer composite materials is on average 30-40% longer as compared with the currently utilized systems.

Sanitary and toxicological examination of the developed polymer composite materials proves their high ecological safety when used as self-levelling floors in industrial and civil engineering

K.A. Romanova

#### THE USAGE OF THE METHOD OF PRODUCTION PROCESSES MODELING FOR ECOLOGICAL CONTROL

The Minin University, Nizhny Novgorod

The usage of the method of production processes modeling for ecological control is nowadays acute and predetermined by the contradiction between the necessity to raise the effectiveness of ecological control and the lack of adequate modern methods that are implemented into the process. Mathematical methods help streamline the system of economic information, find out the drawbacks in the available information and work out the requirements to prepare or correct the information.

Developing and using economic and mathematical models point to the ways how to improve the economic information aimed at solving particular planning and management tasks. Mathematical modeling is the largest section of modeling. The method does not require high costs to implement. Besides, doing calculations does not take much time with the increased productivity of electronics devices.

The relationships between society and nature have undergone serious changes through the whole history of the mankind. Nowadays the main tasks of such interaction are nature protection, health protection, prevention of harmful effects of economic activity on the environment, improvement of the nature and the increase of its quality.

Inspection including ecological control is exercised by the Ministry of natural resources and ecological control of Russia Federation. Unfortunately ecological control has been regarded recently as not enough effective because of the lack of adequate methods to assess the impact of the economic activity of households.

Giving the example of galvanic production we suggest implementing the method of mathematical modeling into the system of ecological control. Galvanic production is taken as an example because it is known to be one of the most water retaining industries bringing priority substances, which can case cancer, into the environment.

Galvanic surface treatment plays an important role in the world practice that is why complete rejection has no grounds. Galvanic covering turns out to be one of the top- priority methods to achieve specific and special features of metallic and non-metallic covering of parts. They help to solve the problems of raising corrosion resistance, improving consumer attributes of products, durability and high surface hardness.

According to the technological processes of different galvanic productions the most dangerous elements of galvanic waste are heavy metals (zinc, chromium, tin, bismuth, lead, cadmium, mercury, iron, copper, etc.).

Mathematical methods and computers been widely used in different spheres of human activity since the middle of XX century. At those times new areas of science appeared such as mathematical economics, mathematical chemistry, mathematical linguistics etc. studying mathematical models of existing objects and events as well as the methods to investigate these models. A mathematical model expresses the essential features of an object or a process using the language of equations and other mathematical tools. The way of mathematical modeling in our time is much more comprehensive than a full-scale simulation. The appearance of a computer gave a boost to the development of mathematical modeling, although the method arose simultaneously with mathematics a thousand years ago.

A mathematical model is an approximate description of a class of phenomena or objects of the real world with the help of the mathematical language. The main purpose of modeling is to explore these objects and predict the results of future observations. However, modeling is also a method of learning about the world enabling us to manage it.

The main stages of mathematical modeling:

- 1. Model construction
- 2. Solution of the mathematical problem that leads to the model
- 3. Interpretation of the conclusions from the mathematical model
- 4. Check the adequacy of the model
- 5. Model modification

We used linear programming which is known to be an aspect of mathematical programming studying the methods for solving extreme problems, which are characterized by a linear dependence between variables and linear criterion. The necessary condition for setting a linear programming problem is restrictions on the availability of resources,

the value of demand, production capacity of enterprises and other production factors. In addition, a linear programming problem is to choose the most profitable (optimal) plan from the variety of feasible plans.

We applied a linear programming design of a model by the assessment of four processes: copper plating, nickel plating, chrome plating and galvanizing. All these processes are aimed at the protection and decoration of products, ie they perform the same function. We defined the problem to determine the least harmful galvanic processes by mathematical modeling in mathematical package Mathcad and Excel using the function of the "Search for solutions." The following points were taken into consideration: the system of restrictions, the concentration of contaminants, ways of solutions, ie the acceptable contaminant level.

In our case with the help of mathematical package Mathcad and Excel, we obtained the following data: during the coverage of two parts in chrome plating and galvanizing bath, concentration of emissions in the processing will not exceed the level of pollution in accordance with the national standard , and for the same items only in baths copper plating and nickel, the concentration of emissions exceeds the permissible level. This in turn will lead to the fine of 65 thousand rubles for pollution.

Thus, it can be stated that the mathematical modeling is accurate, and most importantly an effective method of environmental control. using a computer it can in the shortest period of time (in a few minutes) calculate the level of contamination by an enterprise and identify the exact amount of damage to the natural environment.

Tuyakbai Rysbekov

### ÖKOLOGISCHE BILDUNG UND ERZIEHUNG DER GESUNDEN LEBENSKULTUR

. M.Utemissow West-Kasachstanische staatliche Universität, Uralsk

Für die Ausbildung der hochqualifizierten Spezialisten ist es heutzutage nicht genügend, nur berufliche Kenntnisse und Fähigkeiten zu beherrschen, es ist sehr wichtig, die heranwachsende Generation zu lehren, regelmäßig die Gesundheit zu stärken, sich durch Grundlagen der gesunden Lebenskultur zu vervollkommnen.

Es ist heutzutage sehr wichtig, da die Kennziffern des Gesundheitszustandes moderner Jugendlichen, die Tendenz zur Entwicklung verschiedener Erkrankungen im Laufe der Ausbildung im Bildungssystem, verschiedene Erscheinungsformen der schädlichen Gewohnheitensvorliebe, die den unverbesserlichen Schaden für die Gesundheit bringen– das alles charakterisiert die Notwendigkeit nach der Suche der wirksamen Orientierungspunkte für Gesundheit, daneben auch Bildung der günstigen Bedingungen im Studium- und im erzieherischen Prozess für den Einschluss der Jugend in die aktive Tätigkeit, die auf die Erhaltung und Festigung der individuellen und öffentlichen

Gesundheit gerichtet sind, unter Berücksichtigung aller seiner bildenden Komponenten.

Mit der Entwicklung der sozial - praktischen Tätigkeit der Menschen, mit dem Wachstum der Produktion haben die Maßstäbe der menschlichen Einmischung in die umgebende Natur stark zugenommen, und es gibt die Tendenz mehr und mehr, im größeren Maß, das Gleichgewicht der natürlichen Prozesse zu verletzen (die Luftvergiftung, Beschädigung der Bodendecke, thermische und chemische Ansteckung und Verschmutzung des Wasserbassins des Planetes usw.), dass hat die Qualität des Lebens der Leute verschlimmert. Das Problem der gesunden Lebensweise des Menschen ist mit der ökologischen Sicherheit des Landes eng verbunden. Gerade deshalb wird in Kasachstan die erhöhte Aufmerksamkeit zu den Problemen der ökologischen Sicherheitsversorgung zugeteilt.

In der Strategie "Kasachstan - 2030" sind die begrifflichen Grundlagen der ökologisch sicheren Entwicklung der kasachischen Gesellschaft auf die langfristige Periode fixiert. Die Konzeption der ökologischen Sicherheit der Republik Kasachstan auf die Jahre 2004-2015, die vom Beschluss des Präsidenten RK vom 3. Dezember 2003**r**. gebilligt sind, ist ein Dokument, das die Hauptlagen der langfristigen Strategie "Kasachstan - 2030" in der ökologischen Sphäre entwickelt und konkretisiert. In diesem Dokument ist als Hauptziel die Versorgung der Beschütztheit der natürlichen Systeme, lebenswichtige Interessen der Gesellschaft und die Rechte der Persönlichkeit von ökologischen Bedrohungen als staatliche Politik auf dem Gebiet der ökologischen Sicherheit bestimmt. Für die Errungenschaft der gegebenen Ziele ist es notwendig:

- Bildung der günstigen Bedingungen für die Senkung der natürlichen Kapazität der Produktion durch die Einführung der abproduktarmen und abfallfreien Technologien, Verschärfung der ökologischen Forderungen an ökonomische und andere Tätigkeit;

- Berücksichtigung des Ökosystemsprinzips in der rechtlichen Regulierung der öffentlichen Beziehungen auf dem Gebiet des Umweltschutzes und rationaler Naturausnutzung;

- Einführung der naturschützenden Normen in die Gesetzgebungsakte, Systematisierung und Konkretisierung der Normen in der Umweltbewahrung und der Naturschätze;

- Entwicklung der ökologischen Bildung und Erziehung, wissenschaftliche Versorgung der ökologischen Tätigkeit, staatliche Unterstützung der ökologischen Bildung, Information über die möglichen Wege der Ökologisierung der produktiven und nicht produktiven Tätigkeit, Ausstattung der Ausbildung von neuen Lehr-und methodischen Unterstützungen über das Umweltmanagement.

Die ökologische Bildung ist die Wissenschaft über Schönheit der gesunden Lebensweise, der richtigen Beziehungen des Menschen mit der Umgebungswelt, und der Menschen miteinander. Nur eine gute Vorbereitung und Bildung der Jugendlichen kann erlauben, die richtige Lebensweise vom Falschen abzutrennen. Der Eingliederungsprozess der modernen Schüler und Studenten an die gesunde Lebensweise, Freundschaftsbund mit der Natur, ist mit großen Schwierigkeiten und Widersprüchen verknüpft. Daran

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kann man Widersprüche zwischen dem erreichten Bildungsniveau der Jugendlichen und ihrer Lebensweise beziehen. Im Laufe der Ausbildung der ökologischen Kultur, die auf der Einigkeit der Formierung des schöpferischen Menschen gebaut ist, wird es nötig sein, die notwendigen Bedingungen zu schaffen:

1) bei den Schülern die Fähigkeit zu formieren, richtig das Schöne in der Kunst und in der Wirklichkeit zu verstehen;

2) bei den Kindern das Streben zu formieren, die Schönheit zur Umwelt beizutragen;

3) die emotionale und wertmäßige Beziehung zur Welt zu formieren, auf solcher Weise kann man hohe Ergebnisse in der Bildung und ökologischer Entwicklung der Persönlichkeit der Schüler erreichen, die in der Zukunft in der Persönlichkeiten zu einem hohen moralischen und geistigen Niveau umwandeln werden.

Saltanat Rysbekova

### VERVOLLKOMMNUNG ÖKOLOGISCHER BILDUNG UND ERZIEHUNG IN HOCHSCHULEN DER REPUBLIK KASACHSTAN

Al Farabi Kasachische nationale Universität, Almaty

Die ökologische Bildung und Erziehung sind die wichtigsten Faktoren der Versorgung der ökologischen Sicherheit und des Umweltschutzes. Diese Probleme entstanden mit der Entwicklung der Menschheit. In der Urgesellschaft interessierten sich noch die Menschen dafür, um der jungen Generation die gesammelten Erfahrungen der Beutenahrung, den Schutz vom Unwetter und die Angriffe der Raubtiere, die Erfahrung der Jagd usw. weiter zu geben. Der Menschheit wurde offensichtlich, dass die weitere Zivilisationsentwicklung nach dem ausgeprägten Weg wegen der globalen Veränderungen in den Wechselbeziehungen des Menschen mit dem Umweltschutz unmöglich ist. Die neue Generation, wahrgenommen die Erfahrung der Vorfahren, verwendete es, ergänzend und vollkommend dabei mit mehr Neuerem. Der Mensch beginnt die Natur von der Wiege zu fühlen. Von der Wiege an erspäht der Mensch genau ihre mannigfaltige Welt. Die Natur schenkt so viel Freude, Begeisterung, die hellen Eindrücken. Die Schönheit der Natur bewunderte die Menschheit zu allen Zeiten. Die menschlichen Generationen auf der Erde, von den altertümlichsten Zeiten, einander ersetzend, ermüden nicht, sich für die ästhetischen Erscheinungen in ihr zu begeistern. Ebendeshalb kommt die Natur neben dem Menschen und der öffentlichen Beziehungen vor wie der vollkommene Etalon der Schönheit ein ewiges, entwickelndes und änderndes Objekt.

"Der besondere Wert der Schönheit der Natur besteht darin, dass sie das Gefühl der Befriedigung ohne vorläufige intellektuelle Vorbereitung herbeirufen kann, seiend, so zugänglich allen".

Ökologie ist zu einem moralischen Problem geworden. Das Leben der Natur, der Zustand des Planeten hängt von der Lebenseinstellung des Menschen, von seinem Gewissen ab, weil gerade der Mensch unter allen übrigen lebendigen Wesen über die Vernunft verfügt. Zum Wald gekommen, ist ein Mensch im Zustand viel Noten anzurichten und einzig was ihn zurückhalten kann, seine Erziehung und sein Gewissen. Die Erziehung von der frühsten Kindheit.

So entwickeln sich von der Generation zur Generation die Volkskultur und die Volkspädagogik. Die Volkspädagogik ist zu einem selbständigen Gebiet der Volkskultur geworden, hat das ganzheitliche System der Ausbildung und der Erziehung unter Berücksichtigung der spezifischen Besonderheiten der Nationen, der Völker, der Völkerschaften, der Regionen geschaffen. Deshalb bei jedem Volk, der Nation, der Region hat sich die eigenartige Kultur der Erziehung gebildet, die aus der Generation in die Generation vervollkommnet.

Historischausgeprägthaben die Lebensweise und die wirtschaftlich-Produktionstätigkeit des kasachischen Volkes auf die Bildung und die Entwicklung der Volkserziehung beeinflusst. In der kasachischen Gesellschaft, wo das ganze Leben und das Erwerbsleben mit der Natur und Tieren verbunden waren, führten die natürliche Lebensweise, die Erziehung der Kinder trug den Naturbildlich charakter und die Naturschutzausrichtung. Deshalb verhielten sich Kasachen zur Natur vorsichtig, hielten für die Heiligkeit und den Hochwürden die Welt der Flora und der Fauna, verschmutzten Seen und Flüsse nicht. Die Werke der hervorragenden kasachischen Aufklärer - der Demokraten, der Dichter und der Schriftsteller (Tschokan Walichanow, Ybraj Altynsarin, Abai Kunanbajew, Schakarim Kudajberdyyly, Alichan Bukejchanow, Achmet Bajtursynow, Magzhan Schumabajew, Schusipbek Ajmautow, Mirzhakip Dulatow, Halel Dosmuchametow, Ilias Schansugurow, Saken Sejfullin) sind von ihren pädagogischen Blicken nicht abgetrennt.

Heutzutage, unter den Bedingungen der Globalisierung und der Revolution auf dem Gebiet der informativen und Kommunikationstechnologien, die ökologischen Probleme wurden so ernst, dass man für die Bildung des ökologischen Bewusstseins alle Kanäle der Einwirkung auf die Persönlichkeit verwenden muss. Die Verbreitung des Wissens, der Fähigkeiten, der Fertigkeiten ist eine Aufgabe der Fachkräfte - der Ökologielehrer, aber die Bildung der vorsichtigen Beziehung zur Natur, der Bereitschaft, die ökologisch zweckmäßigen Strategien der Tätigkeit zu wählen, ist eine Aufgabe aller Pädagogen.

Die Vorbereitung der Fachkräfte für die berufliche Arbeit auf dem Gebiet der Umwelt und der rationalen Nutzung der Naturschätze verwirklicht sich in den Hochschulen. Eine der Hauptaufgaben der ökologischen Bildung und der Erziehung jedem Menschen das Verständnis aufzupfropfen, dass die Produktionsfragen komplex entscheiden muss, den Produktionseffekt mit ökologisch, rational gegenüberstellend, die Naturschätze für die Versorgung der normalen Bedingungen des Aufenthaltes und der Tätigkeit der gegenwärtigen und zukünftigen Generationen der Menschen zu verwenden. Die ökologische Bildung erscheint auf die Probleme der Prognostizierung der zukünftigen Ereignisse, gewährleistet die ganzheitliche Wahrnehmung der Erscheinungen des Umweltschutzes. Nach Einstellung

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**CONSUMPTION** 

der Methodiker ist die ökologische Bildung als eine führende Lage in der ökologischen Politik des Staates einzunehmen. Gerade deshalb, die Fragen des Umweltschutzes und die rationale Nutzung der Naturschätze verhalten sich zu den Prioritätsrichtungen der staatlichen Politik Kasachstans. Die ökologische Politik, durchgeführt vom Staat, sieht die konsequente Durchführung der strukturellen Umgestaltung der Produktionssphäre vor, die Vervollkommnung des technologischen Niveaus der Produktion, aufnehmend Ressourcesparen, Anwendung der abproduktarmen und abfallfreien Technologien, Kürzung der Auswürfe und der Ableitungen der verschmutzenden Stoffe in die Umwelt, die Verwertung und die Abfallaufbereitung.

L.A. Safronova E.I. Tikhomirova A.A. Makarova T.V. Anohina PROBLEMS OF RECY AND PRODUCTION WASTE Saratov State Technical University

AND PRODUCTION WASTE Saratov State Technical University named after Yu. Gagarin, Saratov

RECYCLING

OF

One of the main problems, having priority social, economic and ecological value, is a problem of pollution of environment with firm production wastes and consumption. Many industrial wastes are considered as the valuable products which are subject to a material recycling, that is processing with receiving materials suitable for use though thus there are difficulties as a waste is the non-uniform, difficult polycomponental mixes of substances possessing various physical and chemical properties, have toxic, chemical, biological, fire - and potential of explosion. Need to process, for example, a polymeric waste under doubt isn't put today, however the choice of the most justifiable way of processing depends on a large number of the factors considering not only an economic benefit, quantitative indices, but also quality indicators of a polymeric waste.

Among the huge amount of plastic waste can be identified polymeric waste the medical industry, the share of which is increasing every year due to the growth of such products, such as disposable syringes, disposable blood transfusion systems, droppers, catheters, gloves, etc. Not being collected and processed in a timely manner, such products may be misused and cause the spread of infectious diseases and epidemics. Particular attention should be paid to the sub-standard medicines and pharmaceutical products and medicines mixture expired.

Most people throw medicine expired in the trash or let down their drains, exposing thereby risk public health and the environment. Danger lies in the fact that the presence of antibiotics in soil and water can lead to bacteria and viruses that are resistant to most drugs in use today. In addition to antibiotic drugs contain many other chemicals, including hormones that can lead to infertility, increased incidence of cancer, the development of neurological and psychological disorders.

The problem of search methods for the environmentally safe disposal of substandard

drugs is currently very topical. The complexity is due to utilization of a variety of drugs on their chemical structure. They are represented by the compounds and inorganic nature, mainly derivatives of almost all classes of organic compounds - from alkanes, aromatic hydrocarbons and their derivatives up to heterocycles, inclusive. The complexity of a disposal of medicines in the form of liniments (ointments, emulsions, suspensions) is due not only to the chemical nature of the existing diversity of physiologically active components, but also by specific physical and chemical properties of excipients considered drugs.

The first step in selecting the method of waste management is to determine the class of hazardous waste. In our country, waste is classified into five classes of danger. Hazard Class is set to determine the safest way and the accommodation, travel, waste disposal, and of belonging to it depends on the cost of recycling and disposal.

Definition of waste hazard class of various industries is an important task in the preparation of passports waste in their inventory.

Hazard class of waste is calculated by the method of "the criteria for classifying hazardous waste classified as dangerous for the environment" and the SP 2.1.7.1386-03 "Sanitary rules to identify the hazard class of toxic waste and consumption." The method is based on the calculation of indicators of the degree of hazardous wastes in its impact on the environment.

To confirm the class of risk of calculation methods used by the experimental method bioassay. The method is based on the bioassay of aqueous extract of waste. We used the following methods: Analysis of toxic water in mortality and fertility changes in Daphnia HDPE FT 14.1:2:3:4.5-2000 (test - object Daphnia Magna Straus); Analysis of toxic water, water extracts from soils, sewage sludge and waste by the change in fluorescence of chlorophyll and change the number of algal cells FR.1.39.2001.00284 (test - object Scenedesmus quadricauda).

The objects of the study, we took a few types of waste production, hazard class are in the Federal Waste Catalogue classification is not installed: galvanic sludge, waste containing oil and petroleum products, sludges from washing vehicles; washings electroplating. We studied polymer waste: plastic bags contaminated barium carbonate. The chemical composition of waste: polypropylene - 89.5%, PE - 10%, barium carbonate - 0.5%. The investigation of waste oil drugs medicines, water-soluble and mixture of medicines in concentrations ranging from 1 to 0.05%.

As a result of the carried-out researches by a settlement method it is established that galvanic sludges; the withdrawal containing oil and oil products and washing waters of galvanic production belong to the 4th class of danger, and the sludge from a sink of motor transport treats the 5th class of danger. Calculations for both techniques showed the 2nd class of danger of a withdrawal polipropilenovy bags polluted by a barium carbonate. The settlement method of definition of classes of danger wasn't applied to a waste of medical preparations in connection with a problem of establishment of a chemical composition of a waste.

Besides, classes of danger of a waste are determined by a biotesting method by mortality

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of water fleas of Daphnia Magna and on decrease in number of cages of green protokokkovy algas of Scenedesmus quadricauda.

It is established that galvanic sludge treats the 2nd class of danger, and a withdrawal containing oil and oil products and a withdrawal washing waters of galvanic production belong to the 3rd class, sludge from a sink of motor transport treat the 4th class of danger. Biotesting on water fleas and on microalgas established the 5th class of danger of a withdrawal polipropilenovy bags polluted by a barium carbonate.

At definition of a class of danger of a waste of medicines eÕpired (sub-standard) by a method of biotesting it is shown that for a withdrawal oil medical preparations: the death made from 14 to 30 % of water fleas, inhibition of number of algas of 35-64 % that, according to techniques, allows to carry a withdrawal to the 3rd class of danger. For a withdrawal of water-soluble medical preparations: the death of water fleas made 95-100 %, inhibition of number of algas from 46 % to 72 %., that allows to carry a withdrawal to 1 class of danger. For a withdrawal of a mix of medical preparations: the death of water fleas made 90-100 %, the inhibition of number of algas of 98-99 % - a withdrawal belongs to 1 class of danger.

At comparison of the received results of definition of a class of danger of the waste which has been carried out by different methods, distinctions in certain classes of danger to a studied waste are established, is shown that a biotesting method a studied waste belongs to higher class of danger though for a withdrawal polipropilenovy bags polluted the carbonate of barium observes a return picture. The obtained data on definition of a class of danger by a settlement and experimental method don't coincide. It is connected with that the settlement method is individual as definition of a class of danger occurs on separate components making it, and the method of biotesting is complex, considering mutual influence of components making a withdrawal. Therefore, confirmation of a class of the danger received by a settlement way, by means of a biotesting method is obligatory.

Thus, it is confirmed that degree of toxicity of a waste is influenced by factors which aren't considered at a settlement method of definition of a class of danger of a withdrawal, for example, mutual influence of components of a withdrawal at each other. Therefore the preference in establishment of a class of danger remains behind experimental methods and for more authentic establishment of a class of danger of a being formed waste it is necessary to carry out their biotesting. Therefore for increase of reliability of toxicological control it is necessary to create such conditions for the enterprises when they will be compelled to increase accuracy of measurements and to hold events for reduction of negative influence of this withdrawal on environment, choosing the most optimum ways of processing of a waste.

Having defined a class of danger of a waste it is possible to recommend the most optimum and ecologically safe ways them to utilization – thermal decomposition with access or without access of oxygen of air, burial on ranges of a firm waste or processing by means of the latest modern technologies.

I.E. Semenov

### AUTONOMOUS INSTALLATION FOR CONDENSATION OF FRESH WATER FROM ATMOSPHERIC AIR

Technical University named after N.E.Bauman, Moscow

Deficiency of fresh water becomes one of the primary factors constraining development of a civilization in many regions of the Earth. For the period of time since 1950 to 1980 consumption of fresh water in year on the Earth has increased as four times and has reached 4000 km<sup>3</sup>. The water expense on one inhabitant of modern city is 100-350 liters. However in many countries this figure is reduced up to 20 liters as a result more than billion person on the Earth are not provided even potable water.

The idea of use a natural cold of the Earth has come to the author in the hot and droughty summer of 2002 when during walk he has found out mushrooms in completely dry wood, that at full absence of rains on an extent more than 3 weeks were surprising. Mushrooms grew only in several places, namely in the locations of large stones of a glacial origin practically buried in the ground, and the surfaces, stones acting from the ground always have been covered with a layer of water. Surfaces of stones in some cases made up to 0.3-0.4 sq. meter, and on distance up to 0.5 meters from them all ground was damp. How was there such intensive condensation in the afternoon at temperature of air more than 25°C? All business appeared that all volume of a stone was in the ground and had the temperature close to temperature of soil on depth more of two meters from a surface which in an average strip of Russia changes from 10 up to 12°C, i.e. the stone was cold enough for process of condensation. Many animals in deserts use a natural cold of the ground and bury in sand in the afternoon. Why not to use us a natural cold of the ground for cooling a surface of the condenser?

Technical problem became for us creation of installation for receipt of fresh water from the atmospheric air, using renewed energy sources with increase the efficiency of performance of a condensing surface and ensuring of full autonomy at work.

The technical result is achieved by that in installation for condensation of fresh water from the atmospheric air [1], containing solar collectors, solar batteries, refrigerating system, a watercatch, an airline and ventilating system, highly effective system of condensing panels of a special design is entered as the condenser, and as a source of a cold superficial layers of the ground on some depth are used. The positive effect is achieved due to as the condenser highly effective system of condensing flat thin-walled panels is used, and as a source of a cold are used natural sources of a cold– namely superficial layers of the ground on some depth. Installation works as follows. In the afternoon there is an accumulation of thermal energy in heat-exchanging column due to work of flat solar collectors and electric energy in accumulators of storage station, due to work of solar batteries. At night the temperature of a surface of the ground and air starts to decrease due to radiating radiation. Due to heat-exchanging column filled
hot water which is heated up in the afternoon by flat solar collectors in a discharge pipe of the frame of installation the stream of warm air is created. As a result of a difference of pressure atmospheric air acts through an open bottom part inside of the frame and comes into contact all over again to the bottom tier, and then and with the top tiers heat-exchanging panels and through a discharge pipe leaves in an atmosphere. If relative humidity of air is close to 100 % taking place in it water steam it is condensed on surfaces heat-exchanging panels, and the received water flows down in the tank. If relative humidity of air is less than 100 %, but is more than 80 % all over again air is cooled at a surface heat-exchanging panels up to temperature when pairs becomes saturated, and then there is a condensation. At heating water in the tank of a refrigerator the system of automatic control other tank is higher than the established temperature connects to work, and in the switched - off tank there is a cooling water by natural heat exchange to a cold soil of the ground. Then process repeats in the same sequence. For work of the given installation it is not required to any energy, except for solar, it functions in an automatic mode and is thus absolutely non-polluting.

1. Patent R.F. N 2256036 «Independent installation for condensation of fresh water from atmospheric air ».

I.V. Sergeyeva E.S. Sergeyeva	BIOASSAY	METHOD	FOR	ECOLO	GICAL, S	SANITARY
	AND HYG BODIES	ENIC MON	NITORING	OF	NATURAL	WATER
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Saratov State Agricultural University, Saratov, Saratov State Medical University, Saratov

Saratov Oblast, Russian Federation, is classified as the area with low environmental quality. Emissions from some enterprises in Saratov belong to the 1<sup>st</sup> and the 2<sup>nd</sup> classes of environmental hazard. Saratov Oblast has abundant water resources. It is one of the most affluent areas of the Volga region.

Ability of living organisms to survive in conditions of anthropogenic pollution is widely used for assessing quality of aquatic environment. Larvae of chironomids (Diptera) are common dominant species in macrozoobenthic communities. They are frequently used as bioassay test-objects of water quality.

We used larvae of subfamily Tanypodinae (Diptera, Chironomidae) for environmental assessment of watercourses in Saratov Oblast. Among benthic organisms, these larvae are particularly sensitive to water contamination. They form bioassay test-object complex including 41 species. These larvae are adapted to various types of water bodies and watercourses and are associated with different types of silt, which facilitates their dispersion and prevalence over other chironomids.

In 2000-2012, we studied 22 shallow water bodies (small rivers, rivulets, and ponds) in Saratov Oblast. We observed two patterns: on one hand, some normally abundant Tanypodinae species disappear from macrobenthos or become rare; on the other hand, some cosmopolitan Tanypodinae species expand or even become anthropophyllic.

Presence of various species of Tanypodinae allow assessing ecological and sanitary condition of water bodies, particularly establishing whether they belong to the  $4^{th}$ ,  $5^{th}$ , or  $6^{th}$  class of water quality.

For example, class 4 of water quality (medium contamination, or mesosaprobic) is characterized by presence of larvae of Clinotanypus nervosus (Meigen), C. pinquis (Loew), Tanypus kraatzi (Kieffer), T. punctipennis Meigen, T. stellatus Coquillett, T. vilipennis (Kieffer), Procladius (H.) choreus (Meigen), P. (H.) crassinervis (Zetterstedt), P. (H.) culiciformis (Linnaeus), P. (H.) ferrugineus (Kieffer), P. (Ps.) rufovittatus (V. d. Wulp), P. (Ps.) imicola Kieffer, Anatopynia plumipes (Fries), Macropelopia nebulosa (Meigen), M. adaucta Kieffer, Psectrotanypus varius (Fabricius), Natarsia punctata (Fabricius), Thienemannimyia carnea (Fabricius), Th. laeta (Meigen), Th. lentiginosa (Fries), Rheopelopia maculipennis (Zetterstedt), Conchapelopia melanops (Meigen), C. viator (Kieffer), Xenopelopia falcigera (Kieffer), Larzia curticalcar (Kieffer), Labrundinia longipalpis (Goetghebuer), Monopelopia tenuicalcar (Kieffer), Ablabesmyia monilis (Linnaeus), A. longistyla Fittkau, and Apsectrotanypus trifascipennis (Zett.).

Water bodies with higher degree of contamination classified as polysaprobic (class 5 of water quality) are inhabited by Tanypus punctipennis Meigen, T. vilipennis (Kieffer), Procladius (H.) choreus (Meigen), P. (H.) crassinervis (Zetterstedt), P. (H.) culiciformis (Linnaeus), P. (H.) ferrugineus (Kieffer), Macropelopia nebulosa (Meigen), Psectrotanypus varius (Fabricius), Natarsia punctata (Fabricius), Rheopelopia ornata (Meigen), Labrundinia longipalpis (Goetghebuer), Monopelopia tenuicalcar (Kieffer), Ablabesmyia monilis (Linnaeus), A. longistyla Fittkau, and Apsectrotanypus trifascipennis (Zett.).

Procladius (H.) choreus (Meigen), P. (H.) ferrugineus (Kieffer), Natarsia punctata (Fabricius) live in waters with supreme degree of contamination (polysaprobic waters, class 6 of water quality).

Larvae of some species live only in clean waters while others inhabit moderately polluted waters. Anthropophyllic species are able to survive in highly polluted aquatic environment. Larvae of other species can inhabit waters of various qualities. When such species are detected in a surveyed water body, the class of water quality is established either by the most dominant species, or by a serious of species that are characteristic for a single water quality class only.

Commonly used as bioassay test-objects for contaminated and eutrophic water bodies, Procladius (H.) choreus (Meigen) and Procladius (H.) ferrugineus (Kieffer) are able to inhabit waters of varying degrees of contamination. P. ferrugineus prefers waters saturated with organic matter but fails to survive in chemically polluted aquatic

environment where P. choreus has competitive advantage.

The proposed method is simple and time-efficient. It has low cost and allows rapid data collection on water pollution levels. Thus, water body can be evaluated fairly fast for water quality class and saprobity. Obtained data allows predicting the duration of water use from a water body as well as determining priorities, selectivity and comprehensive sanitation procedures for remediating water quality. The method can be used for express survey of water quality as well as for a long-term monitoring of a water body.

A.A. Shalaginov

#### HEAVY-CURRENT CONTACT SYSTEMS WITH COMPOSITE LIQUID-METAL CONTACTS OF THE ELECTRICAL APPARATUSES

Research Institute for Marine Systems Ltd., Saint Petersburg

The aim of the present study is the development of new designs for heavy-current contact systems (HCS) with composite liquid-metal contacts (CLC) for electrical apparatuses.

It is known, that CLCs possess a great number of advantages:

• operational life - 3000-5000 and even more switch on/switch off operations (on-off);

- 100% savings on silver;
- Savings on liquid metal;
- Minimum transient resistance,
- Minimum electrical power loss,
- Minimum press force,
- Absence of electrodynamic kickback forces,
- Absence of such phenomena, as welding, vibration and sealing of contacts;

• Increase in inclination angle relative to horizon does not influences the CLC resistance greatly;

- Easy to use in conjunction with existing electrical apparatus;
- Easy to operate and maintain;

Because of the above, the task of developing new design of HCS with CLC for modern electrical apparatus appears to be of high priority. Shalaginov's designs of HCS Nos. 1 - 6 are presented in the present study. These HCS designs were developed to ensure further increase in rated current value, decrease of transient resistance, growing reliability, simplified design and longer operational lifetime. In this regard, the electrical contact between the side surfaces of the inner cavities of the fixed bridge and the contact element in these systems is performed in different ways.

Based on the results of the research accomplished these designs of HCS with CLC

may be recommended for application in electrical apparatus, specified for chemical industry, metallurgy and other segments of industry.

We have several patents for utility models. It is Russian patent N 1805509 heavycurrent contact system N 1 Shalaginov; Russian patent N 1795524 heavy-current contact system N 2 Shalaginov; Russian patent N 105 069 heavy-current contact system N 4 Shalaginov; Russian patent N 105 070 heavy-current contact system N 5 Shalaginov and Russian patent N 102 841 heavy-current contact system N 6 Shalaginov

A.A. Shalaginov S.G. Tishchenko	HIGH-CURRENT CONTACT SYSTEM		
	Research Institute for Marine Systems Ltd., Saint-Petersburg		

The work is dedicated to study of high-current contact systems (HCCS) of electrolysis enterprises of chemical and metallurgical industries.

The goal of the present work is to develop the HCCS with compositional liquidmetal contacts (CLMC) of the electrical apparatus with the prolonged service life, saving the liquid metals and electric power.

HCCS contains slider and break contact performed by mobile and interacting with fixed contacts, liquid metal and rings fixed on the hollow bottom, bus, dielectric plate and hold-down device, it is additionally supplied with hollow with porous gaskets fixed on the hollow bottom with rings, sealing elements, axis, rotation mechanism, at that the hollows of fixed contacts are allocated horizontally in relation to each other, by surface they interact with gaskets soaked in liquid metals and located in hollows, interact with additional sealing elements, and the slider contact is made rotating around the additional axis and bound by bus with a break contact connected with a hold-down device from one side and with a rotation mechanism from the other side.

The application of the given HCCS with CLMC helps obtain 100% economy of silver through use of CLMC, electrical energy saving through reduction of transitional resistance using the whole area of contact (at that the actual contact area equals to the imaginary one and flow lines are not narrowed), and therefore reduce almost to zero the electrodynamic rebound forces (during moments of switching-on – off commutation (On-Off)), economy of liquid metal due to using the closed hollow (the liquid metal is not splashed during the moments of On-Off commutation), to exclude such phenomena as welding and contact vibration.

The given construction of HCCS with CLMC was patented by RF for the useful model No. 94052 (Authors: A.A. Shalaginov, S.G. Tishchenko).

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Programm Abstracts

S.G. Scheina A.N. Minenko E.N.Minenko

#### METHODE DER AUSWAHL VON ENERGIEEFFIZIENTEN BAULICHEN MASSNAHMEN BEI DER STÄDTEBEBAUUNG

Rostover Staatliche Bauuniversität, Rostov-am-Don

Rasche Bebauung und anschließende Entwicklung der Infrastruktur auf bebauten und unbebauten Flächen zeigen uns wie sich die Umwelt deutlich verändert. Die Bauindustrie ist eine der ökologisch gefährlichsten Branchen weltweit, deswegen führt die Realisierung von Bauprojekten ohne Rücksicht auf bestehende komplexe Zusammenhänge in einem Ökosystem zur Verschärfung ökologischer, sozialer und wirtschaftlicher Situation in verschiedenen räumlichen Ebenen vom Stadtviertel über die Stadt bis hin zur Region. Vor diesem Hintergrund erlangen die Fragen einer ressourcenschonenden Gebäudenutzung, einer effizienten Energieverwendung eine für die Menschheit existenzielle Notwendigkeit.

Im Fokus der Untersuchung steht die Entwicklung von spezifischen baulichen Maßnahmen für eine nachhaltige Lösung von ökologischen Problemen in großen bebauten Räumen am Beispiel von Rostov-am-Don. Forschungsgegenstand ist die vorliegende schlechte Umweltsituation in der Stadt. Ein beachtlicher Anteil von Verunreinigungen kommt durch westliche Luftstromübertragung aus Donbass. Es gibt noch eine Ursache dafür- historisch geprägte architektonische Städteplanung: enge Straßen, schlechte Verkehrsverbindung, ständiges Wachstum der Anzahl von neuerrichteten Gebäuden usw. Die vorliegende Methode erfordert eine Berücksichtigung eines komplexen dynamischen Wesens von Ökosystemen. Um das Wesen ihrer Zusammenhänge richtig zu verstehen, sollten mögliche Szenarien des Verhaltens bereits auf früheren Phasen der Bauprojektentwicklung simuliert werden sowie potenzielle Risiken mit Risikosteuerungsplanung erarbeitet werden. Folgende umweltfreundliche Maßnahmen sind in jeder Phase des Gebäudelebenszykluses zu beachten:

- Energieressourcenschonung und energieeffiziente Gebäudebauen;
- Senkung des Energiebedarfs und Verbrauchs an Betriebsmitteln;
- Einsatz wiederverwendbarer oder verwertbarer Bauprodukte/Baustoffe,
- Verlängerung der Lebensdauer von Produkten;
- gefahrlose Rückführung der Stoffe in den natürlichen Lebenslauf.

Durch die Analyse von modernen energieeffizienten Technologien wurde ein Optimierungsmodel erarbeitet. Es stellt ein Algorithmus des Lösungsansatzes der Auswahl optimaler aus der technischen, ökologischen sowie ökonomischen Sicht baulicher Maßnahme vor.

Eine erfolgreiche Verwirklichung der wissenschaftlichen Arbeit wird zur neuen Fragestellung im Rahmen der Dissertation beitragen – Gestaltung der nachhaltigen Entwicklung der ganzen Region. Svetlana Sheina Liya Babenko Pavel Shumeev Ekaterina Belaya

## ENVIRONMENTAL MONITORING AND ASSESSMENT OF CONDITION OF LISTED BUILDINGS AND EDUCATIONAL FACILITIES

Rostov State University of Civil Engineering

Currently it is a critical situation when every year due to aggressive external factors hundreds of educational facilities and thousands of listed buildings are under threat of destruction. The traditional reasons, such as mistakes in the reconstruction and restoration, the impact of urban development and economic activity, added excessive loads associated with an increase of ecological and geological risk.

In many ways, the state of affairs is due to lack of improved and effective integrated management system for listed buildings and educational facilities. Lack of instructional materials, which determines the structure of the system of environmental monitoring, the procedure for environmental monitoring and its place in the system of listed buildings' and educational facilities' protection, has led to the fact that most of the regional regulations do not consider "monitoring", which is a direct threat to the conservation of such buildings.

These studies focus on the development of the concept of environmental management system of technical condition of listed buildings and educational facilities based on studies of ecomonitoring of the interactions and processes in the system "environment a building". It includes the three subsystems: monitoring of ecological environment (ecological monitoring), monitoring of the geological environment (geological monitoring) and monitoring of the technical condition of listed buildings and educational facilities. The data obtained from the three monitoring systems, are the input parameters of the model construction and operation of a strategic management plan for the improvement of technical condition of buildings of cities.

To assess the causes of damage of listed buildings and educational facilities it is necessary to include "environmental research" on the territory of buildings to the concept of diagnostic methods for environmental monitoring procedures.

The goals of environmental monitoring are following:

- expansion of information management for the conservation of listed buildings;
- conducting continuous observations of damage with the analysis of changes;

- assessment of this technical condition to take measures to prevent damage and loss of cultural and material value of listed buildings;

- verification of the effectiveness of interventions, etc.

Monitoring of listed buildings ' and educational facilities ' condition should be based on the temporal and spatial parameters of the changes and development of the ecosystem in its location, including all anthropogenic and natural components of the protected areas of listed buildings. Otherwise it is not possible to identify the damaging processes in the material of listed building and educational facilities and to forecast its persistence after impact of the complex environmental factors. To address these problems we have done an

ecological zoning of the territory of Rostov-on-Don by successive overlay electronic maps on pollution of air, soil, noise exposure, the index of water pollution, and other indicators, using ArcGIS ESRI.

The use of modern information technology allows us to construct a permanent simulation model of the ecological environment of the city. It includes the analysis and evaluation of the components of environmental pollution in the city, the Scoping of pollution components, integrated assessment of pollution using geographical information systems (GIS), the forecast changes in the ecological environment, the constant updating of electronic maps of the zones of ecological risk, the choice of measures to manage environmental risks through the development of targeted programs preservation of buildings of cities.

Procedure for monitoring of the geological environment of the city was developed to make effective management decisions about technical condition of listed buildings and educational facilities in difficult geotechnical conditions. It included the use of modern GIS technology to build and continuously update digital maps of the city, containing information on hazardous geological processes taking place on the territory of the city. They include the loessial soil, landslide areas, suffusion, karsts, undermining, and others that have a negative impact on the technical condition of buildings located in such areas. Implemented system of geological monitoring allowed to develop management measures of geological risks, rules and regulations for the management of the listed buildings and educational facilities at different risk areas.

Based on these studies we have developed the structure of the system of ecomonitoring of listed building's technical condition, which includes:

- continuous monitoring of changes at the technical condition of listed buildings and its comparison with the reliability-and-quality standards;

- monitoring of the timely implementation of measures for maintenance, repair and prepare for seasonal operation of listed buildings;

- forecast of hazardous geological and ecological processes and the development of measures to reduce their impact on the early stages of appearance;

- continuous monitoring of changes in the geological and hydro geological environment of the city and the comparison of observations with the technical condition of listed buildings;

- prevention of accidents in the monuments of listed buildings in the city;

- the integration of information flows generated by monitoring organizations;

- on the basis of reliable data on the technical condition of listed buildings developing long-term plans and various optimization models for managing of the technical condition of buildings to ensure that they are properly maintained;

- development of special programs for the preservation of listed buildings.

To meet the challenges of integrated management of listed buildings and educational facilities it is necessary to create information-analytical support capable of analyzing of different types of data. Such a system should include:

1. Information part of the system, which allows to register data of listed building and

educational facilities, as well as carry out the storage in the form of an electronic archive of all documents throughout their life cycle (drawings, three-dimensional models, etc.)

2. Cartographic database of digital vector maps and plans of historic towns with visualization of thematic information.

3. Specialized software that allows evaluating the technical condition and analysis of ecological and geological parameters of the territory to produce modeling of buildings including a set of measures to reduce risks. To assess factors can be used GIS, which have the well-developed organizational principles for ordering of environmental information.

The advantage of this system is the flexibility of its information technology, which allows to use the information in the system of protection of buildings. The use of GIS technology dramatically accelerates and improves the quality of conventional maps and plans. GIS systems can help municipalities with a limited budget to get the most out of existing services as these are the technologies that help different departments to work more closely with each other. GIS have been used successfully all over the world as a means of solving different types of problems faced by the government.

On the basis of the research a functional model of operation of the environment in the system "environment – a building" was developed in the form of three components. The data obtained from the three monitoring systems are the input parameters of the model construction and operation of simulation strategic plan for managing of the technical condition of listed buildings of cities.

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#### PILOT-SCALE MODELING OF DEHYDROGENATION PROCESSES IN REACTOR WITH INORGANIC MEMBRANE

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The processes of hydrocarbon catalytic dehydrogenation are known to be characterized by strong equilibrium limitations. Using a membrane reactor permits one to increase the conversion value by the selective removal of hydrogen from the reaction zone and to shift the equilibrium towards the products. In spite of wide distribution of scientific researches in membrane technology the use of membrane is limited at present. The mathematical modeling of membrane reactor allows one to obtain the parameters for achieving the maximum conversion of hydrocarbons and yields of products.

In our work an approach considering the coupling of the thermodynamically "conjugated" reactions in the membrane reactor has been suggested and theoretically realized. The membrane reactor consists of two concentric tubes, where the interior ceramic tube with catalyst bed is placed in the exterior one. The membrane is deposited as a continuous layer on the outer surface of ceramic tube. The hydrocarbon dehydrogenation reaction is carried out over the catalyst in the tube side. Hydrogen permeates from the tube compartment

of the reactor through the membrane to the shell compartment, where it undergoes the oxidation. Selective hydrogen removal combined with its oxidation has been shown to have a significant effect on hydrocarbon conversion. The propane dehydrogenation was considered as modeling process.

The two-dimensional non-isothermal stationary mathematical model of the catalytic membrane reactor for the "conjugated" dehydrogenation process has been developed. Besides heat and mass distributions on length and on reactor radius, the model considers the volume change in the tube and shell sides of the reactor due to reaction stoichiometry and hydrogen diffusion through membrane. The model was improved by accounting the effectiveness factor of catalyst grains in tube side. The pressure drop was taking into account in both tube and shell sides of the membrane reactor.

The balance equations represent a system of differential equations in partial derivatives, which were treated numerically by the method of lines and the appropriate method for ODE solving. The model verification was realized for ethane dehydrogenation in a lab-scale reactor. Good agreement was obtained between the predicted ethane conversion and those measured. Mathematical modeling has allowed us to define the parameter values at which the highest hydrocarbon conversion can be reached. The made calculations have shown the highest efficiency of the membrane reactor with additional hydrogen oxidation in comparison with the tubular one. It was shown that the heat of hydrogen oxidation reaction allows one to minimize energy operating costs for the process of hydrocarbon dehydrogenation. The parameters of estimation of hydrocarbon dehydrogenation in the pilot-scale membrane reactor were optimized.

B.G.Shintimirova

#### **ACTUAL PROBLEMS OF MARINE POLLUTION**

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Kazakhstan belongs to the category of countries of high water shortage. Nowadays intensively polluted water is caused by mining, metallurgy and chemical industries, utilities of cities present a real environmental threat. Most polluted rivers are Irtysh, Nura, Syrdarya, Ili, Balkhash Lake. Groundwater is also polluting, which are the main source of drinking water supply.

There are many lakes in Kazakhstan, most of them are shallow. They are mainly located in the northern and western parts. Most of lakes are salty and bitter-salty, many of which dry up in summer, leaving on the surface coat of various salts. Among the major reservoirs are: the Caspian Sea, Aral Sea, Lake Balkhash, Alakol, Tengiz, and others. The most important waterways are the river Irtysh, Ishim, and Syrdarya, Ural, Nura, Ili, Tobol. 34 runoff is in the share of the rivers Irtysh, Ishim, Syrdarya, Chu and Ural. To presrve the water balance plays important role protection of small rivers. Rural communities, animal farms are mostly located on the banks.

Currently, the ecological situation in Kazakhstan is very complicated. There are five

centers of ecological disaster in the Republic: The Aral Sea, the Caspian Sea, Balkhash, the Semipalatinsk nuclear polygon and the Baikonur Space Center.

Of great concern is the ecosystem of the Caspian Sea, the world's largest inland water basin and unique biodiversity of flora and fauna.

Scale-up of oil production, the expansion of industrial facilities on the coast, on the shelf zone and 11 water areas on the north-east of the Caspian Sea are a real threat to the Caspian ecosystem.

Problems of the Kazakhstan part of the Caspian common key problems of the Caspian sector. To solve these problems is required the combined activities of the Caspian states on balanced use of biological resources and hydrocarbon reserves.

Aral ecological crisis in a number of global catastrophes of the world has a special place and is the result of the largest human intervention into the natural environment of the planet. The degradation of the Aral Sea ecosystem and led to serious social and economic consequences of the region. Physical, material and mental state of the population living here has always been directly dependent on the functions and features of this reservoir. Currently, the region has the growth of infectious, cardiovascular and other diseases of the population, increased infant and maternal mortality.

At the moment there are many projects to restore the ecological balance in the area of the Aral Sea. A number of them are quite realistic and effective solutions to the problems of the Aral Sea.

This situation is exacerbated by pollution and not only freshwater, but also rivers, seas and oceans in general. Toxic pollutants cause the death of aquatic organisms and make the water dangerous to human health.

To solve the problems by the Government of the Republic of Kazakhstan from January 21, 2002 No71 approved the Concept of the water sector and water policy of the Republic of Kazakhstan up to 2010, which sets out the basic ways of solution saving and rational using of water resources. The Decree of the Government of the Republic of Kazakhstan from January 23, 2002 No 93 approved branch program "Drinking water" for the sustainable supply of potable water in sufficient quantity and quality assured adoption of the Water Code of the Republic of Kazakhstan and Law of the Republic of Kazakhstan "On the rural consumer cooperatives of water users," in 2005-2010, will be carried out to develop schemes of complex use and protection of water resources, the major river basins.

The Caspian Sea in the past decade has been to all coastal states a source of enormous resources. On the first place, of course, is petroleum. Thus, in the Kazakhstan sector of the Caspian Sea in the next year is planning to start commercial production at Kashagan. It raises Kazakhstan on the top five world's largest oil exporters. Active industrial production in adjacent sectors is also mining Russian companies. In general, throughout the North-Caspian hydrocarbon production growth has improved dramatically and will be growing. At the same Kashagan, with recoverable reserves estimated 11 billion barrels, the calculated volume of production, according to the company - operator NCOC, is about 370 thousand barrels of oil per day with a possible increase to 450 thousand barrels already in the first

phase of this project [3, c.10].

Certainly, it is good news, since the work of oil companies is directly reflected in the financial well-being of our countries. However, the rapid growth of oil production is a source of great risk. Without exaggeration, it is a threat to the existence of the entire biosphere of the Caspian Sea. This danger is not far-fetched, but very real, because we have to deal, first, with a closed water reservoir. And the accident comparing with at least half of the one that occurred in the Gulf of Mexico April 20, 2010, will be for the Caspian Environment catastrophe. Secondly, the preconditions for the possibility of failures exist, and they are confirmed by serious scientific data.

Obviously, the oil companies are concerned primarily profit-making. And the task of the state in such cases is to create the necessary rules and to make these rules follow. At the third summit of Caspian states, which was held in Baku on November 18, 2010, adopted a joint declaration and signed an agreement on cooperation in the field of security in the Caspian. It is important to implement signed agreements. We should not only eliminate potential accidents, but on the first place to prevent and respond to them, to minimize possible damage. This can help in unique monitoring of the situation in the region. A system that would include all possible types of monitoring to date areas with intensive production of mineral resources - ground-space, geodynamic, geophysical data satellite geodesy, remote sensing of the Earth from space, ground-based systems. And all this is a unique programmathematic maintenance.

Since the Caspian Sea is an area of interest of many countries and large multinational corporations, unique monitoring system of the whole region and, consequently, unique rules for all participants must be determined by the Caspian states, primarily Russia and Kazakhstan.

Approval on intergovernmental level a centralized Russian-Kazakh monitoring system will provide control over the development of natural, geodynamic processes, the state and dynamics of geo-ecological situation in the Caspian region. This will create the opportunity and give you time to preventing measures aimed at the prevention of industrial accidents and reducing the negative effects, thus preserving the unique water basin - the Caspian Sea - not only for us, but for future generations.

L.V. Shvedkova A.V. Antsiferova V.K. Turchaninov

#### DEFERRIZATION OF ALUMINOUS PROCESSING RED MUDS WITH THE AID OF SELECTIVE CHLORINATION

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A red mud (RM) is the largest man-caused material raw generated as a result of bauxite processing for alumina receipt. According the Bayer's method 2.58 tons of bauxite is used for every ton of alumina and at the same time more than 1 ton of red mud generates.

There is an increase in the number the red muds to 2 tons when aluminous processing with the method of agglomeration. RM is stored as a dump after separation from alumina. An annual volume of the RM waste amounts about 2 million tons. The RM is toxic as it has an alkaline reaction (pH under 12.9) as a result of environmental conditions become worse and we have irrational use of the land.

Main constituents of the RM are minerals comprising an iron (content of  $Fe_2O_3$  run up to 60%), silicon (SiO<sub>2</sub> 8%), calcium(CaO 13%), aluminium(Al<sub>2</sub>O<sub>3</sub> 18%), titanium (TiO<sub>2</sub> 5%) as well as vanadium (V<sub>2</sub>O<sub>5</sub> ~0.15%), zirconium (ZrO<sub>2</sub> ~0.12%), lanthanum (Ln<sub>2</sub>O<sub>3</sub> ~0.15%), yttrium and scandium (traces).According to content of the RM constituents it is possible to equate with a crude ore therefore its processing is appropriate.

There are developed following tested methods of aluminous processing. A pyrometallurgical method is made for a large-scale iron extraction to following use in ferrous metallurgy as well as to production of constructional materials. The method is characterized by large capital and energy costs as well as a poor quality of iron-bearing products. A hydrometallurgical method is used basically to additional recovery of aluminous. There were elaborated methods of acid processing based on schemata using spent acid etching solutions of rolled production as well as use of nitric acid. A considerable defect of the schemata is formation of large volume of acid waste need to be utilized. Another direction is immediate use of red mud for building materials, pavement, founding sand blends, coagulants, ceramics, glass fibre, etc. However, in practice operating enterprises didn't solve a problem of the red muds processing in spite of its duration and the presence of offered engineering solutions.

We elaborated a new variety of hydrometallurgical method for the red mud processing, which permits to extract iron and rare-earth metals from it selectively and the most completely. The main idea consists in conversion of ferric oxides being parts of the red muds to water-soluble compounds. It achieves with use of technology of pressure hydrometallurgy and silicon tetrachloride (SiCl<sub>4</sub>) as a chlorinating agent. Depending on medium pH the iron compounds are extracted from the red mud as a whole spectrum of compounds. The compounds are processed simply into haematite, which is a basic raw material of ferrous metallurgy. Furthermore the compounds permit to use it immediately as very beautiful mineral pigments. Their colloidal solutions showed clotting activity against clayey dredge and water polluted with organic matters.

The proposed variety of hydrometallurgical method is directed mainly toward total extraction of iron from the red mud. However, at the same time a remaining red mud will concentrate rare-earth metals. This ensured the technology of iron extraction may acquire a high profitability under complex processing.

Consequently, a selective chlorination of the red mud's ferric oxides as a possibility in principle was established by means of their reaction with silicon tetrachloride. The reaction proceeds in gentle conditions and produces practically useful ferric chlorides.

Z.A. Simonova A.A. Makarova

# STATE OF GREEN PLANT IN DETERMING THE ECOLOGICAL FOOTPRINTING AREA

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Feature of modern cities is a "spread" them on territory, some kind of territorial expansion. This trend is consistent with the ideas of ecological footprinting in which "bring" indicators of the environment is performed using a polarization different functional zones separated by large areas of greenery. The green territory can provide a balance of essential resources in the city and will contribute to the sustainable development of cities.

Green spaces have a number of functions in the city. The main of them are involved in the cycle of carbon dioxide, oxygen and assimilation of many substances in the gas exchange processes. The basic quantity of oxygen in cities is consumed on the oxidation processes of contaminants from different sources. It is established that the amount the oxygen produced by various enterprises of Saratov was 83.46-110.88 thousand tons per year. On processes of oxidation of the polluting substances arriving in atmosphere from all stationary sources of pollution in Saratov and cars, it is consumed about one million tons. Oxygen deficiency in quantity 900 000 tons have to repay for city retirement account with other territories. The city consumes a quantity of oxygen, which produces all the vegetation of the right bank of Saratov region, with an area of 45 thousand km<sup>2</sup>. Therefore, for oxygen balance regulation it is necessary to increase a share of green plantings approximately in 10 times.

However, our calculations are made for healthy trees. But the most cities in Russia is characterized by elevated levels of pollution. The high level of air pollution is characteristic for Saratov - estimated EASA varies from 13.0 to 16.4 with a maximum in May (API = 17.8) and minimum in March (API = 8.2). The main pollutants are particulate matter, carbon monoxide, nitrogen dioxide, phenol and formaldehyde. The purpose of our work is research of stability of plants in actual conditions of the city environment.

Most commonly when studying plant resistance to adverse environment factors the activity of antioxidant enzymes is considered. One of the most commonly used enzymes in plants is peroxidase. This enzyme is quite sensitive to the range of atmospheric pollutants, and increase its activity proves protective tissue reactions in adverse conditions. As the object of study was selected as the Betula pendula Roth., and in various degrees of anthropogenic load parts of the city. Areas of research have been allocated based on the results of chemical analyses of atmospheric air and is located in the bustling traffic and close to the main industrial enterprises. Peroxidase activity determined in the Betula pendula during the growing season by photometric method with oxidation of benzidine.

The results showed: in all areas, including the background, in the Betula pendula peroxidase activity during the growing period decreased, reaching a maximum in spring and autumn a minimum; on average around receded 7 times during the growing season, which is much higher than the background; the maximum values for the activity of peroxidase in the Betula pendula in areas of Saratov main transport nodes. Therefore, it is in these places,

plants are trying to protect themselves from the stress caused by the negative effects of transport. As a result of their adaptive capacity due to the activation of oksidase are flattened to a minimum.

Analysis of the results of this experiment concluded that in the city of Saratov woody plants throughout the growing season are in a state of stress. Plants under stress significantly reduces their productivity, dramatically reduced their contribution to the absorption of carbon dioxide and oxygen. In the city there are no green spaces that are in excellent condition, in a good condition - 22 %, satisfactory-27, bad - 28, drying out-11 %. Hence, at carrying out of calculations on ecological footprinting, it is necessary to enter the correcting indicator considering a condition of vegetative communities in actual conditions of the city environment.

N.V. Sirotkina D.A. Scherbakov

#### FEATURES AND NEED OF PREVENTIVE MANAGEMENT FOR THE FOOD INDUSTRY

: Institute of Management, Marketing and Finance, Voronezh

Due to the high frequency of emergence of crisis situations the food industry is considered one of the most risky spheres of industrial production. The main reason causing the crisis phenomena in functioning of the processing enterprises, the inefficient management, differing as a jet orientation and not allowing to use in practice of management all variety of means and methods of planning of a sustainable development of the enterprise acts.

The nature of the organizational and economic problems arising in the food industry leading to approach of crisis situations, violation of interaction of suppliers of raw materials and other resources with the processing enterprises, caused not effective actions of the managers who are engaged in the organization of planned and look-ahead work is.

So far the world theory and practice of management developed means and the methods, allowing to exercise administration in usual for the enterprise a managing mode (operative, tactical, strategic), in the conditions of crisis (anti-recessionary), and also in the course of prevention of emergence of crisis situations (preventive).

Preventive management represents the special direction of management of the industrial enterprises, realized in the conditions of potentially possible crisis, based on timely detection of indicators of the crisis phenomena and assuming complex use in practice of management of forecasting of changes of an economic environment and development of the long-term and medium-term plans modeling prevention of approach of crisis situations.

The food industry has a number of the characteristics defining special need of primary use in the current and strategic management of tools of preventive management, namely:

- stochastic nature of deliveries of agricultural raw materials for the industrial processing, connected with brave nature of agrarian production;

- need of providing economically expedient level of use of capacities under condition of

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providing the offer of the goods, differing inelastic demand;

- existence of highly competitive environment in the market of the food, caused by presence of a large number of producers of similar production.

The specified features form operating conditions of the enterprises of the food industry and at the same time are the reasons causing approach of crisis situations that causes need of complex and systematic monitoring of branch dynamics, diagnostics of the nature of possible emergence of the crisis phenomena and development of administrative tools of an anticipatory orientation.

The maintenance of preventive management is defined by the following basic provisions reflecting the main features and specifics of this economic category:

- the main objective of preventive management consists in the prevention, prevention of the crisis phenomena in enterprise activity;

- preventive management is directed on maintenance of a sustainable development of industrial production by a way of active impact on a mode of its functioning with a view of elimination of arising deviations from look-ahead values of controllable parameters;

- preventive management assumes development of a complex of administrative actions of the pro-active, anticipatory orientation advancing possibilities of negative change of the external and internal environment of the enterprise, minimizing threats to a sustainable development of production.

Preventive management finds the realization in development of plans of various efficiency and multiple forecasts of behavior of the processing enterprises in the market, and also the other measures promoting adoption of effective administrative decisions, possessing anticipatory properties.

This circumstance testifies to conceptual compliance of the main maintenance of preventive management to modern ideas of effective management of the processing enterprises, created taking into account specific features of the food industry as the branch needing administrative tools of a pro-active orientation. In this regard generalization of an empirical material and development of tools and methods of preventive management of the enterprises of the food industry, promoting increase of administrative culture and directed on ensuring growth and development of the branch enterprises is actual.

E.I. Tikhomirova A.L. Podolsky S.V. Bobyrev

#### EXPERT EVALUATION OF THE EFFECTIVENESS OF ENVIRONMENTAL EDUCATION AT A UNIVERSITY

Saratov State Technical University, Saratov

Ecology is currently booming. Ecological knowledge is expanding exponentially. One of the most important criteria to evaluate the quality of teaching ecology to students is their ability and desire to improve and quickly acquire new knowledge and skills. An essential quality of the educational process is its adaptability to new requirements of the labor market.

The development of the educational process should precede the development of the labor market for at least the time required for training the specialists of new type. Training of specialists is based primarily on defining the choice of criteria of assessment of trainees' professional level. Educational standard sets the desired values for these criteria whereas testing system determines the actual performance achieved over time. Training uses resources determining both quality of education and its costs. Therefore, an educational routine can be designed to address either getting the best possible quality of training the specialists using limited available resources or achieving the required quality with minimal resources. The first scenario may be illustrated by preparation of an athlete to set up a world record. The second case represents training a quality worker for performing some specific operation at a plant. Training ecologists refers rather to the first scenario than the second. Training requirements are constantly changing. Resources needed for the educational process are steadily increasing. In these circumstances, an evaluation of the effectiveness of learning technologies is very important.

Quality of education can be determined by the model methods using established algorithms to compute numeric values of evaluating criteria, or by the expert methods using qualifying experts to determine the choice and relative importance of evaluating criteria. Mismatch between the model and expert estimates is a basis for modernization of the



Figure 1. Integrated diagram of the algorithm of comparative expert assessment of objects of

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educational process. Constantly changing requirements for specialists-ecologists result in increasing importance of expert evaluation of effectiveness of the educational technologies used for training ecologists at universities. Currently, ecologists and environmental managers have to deal independently with large amounts of poorly structured information. This fact points out need in students' competence in information technologies (IT) and, consequently, need in using IT as the most important resource for their training.

We propose assessing of the effectiveness of educational technologies with the help of expert systems. An expert system is a computer system that emulates the decision-making ability of a human expert. Expert systems are designed to facilitate tasks in different fields. Typically, the problem area is complex enough that a simpler traditional algorithm cannot provide a proper solution. The foundation of a successful expert system depends on a series of technical procedures and development that may be designed by technicians and related experts. As such, expert systems do not typically provide a definitive answer, but provide probabilistic recommendations. In our case, expert evaluation of educational technologies, including IT used in the course of environmental education, may require involvement of various experts from different geographical locations.

Thus, to ensure the quality of expert evaluation of educational technologies used at any particular university, we have developed the computer-aided information system allowing us to make a comparative evaluation of several objects resulting in establishing a hierarchy sequence of evaluated objects. In our study, objects to be evaluated in the course of an expertise are innovative educational technologies that we use for teaching disciplines in the field of ecology.

We developed the algorithm for an expert evaluation of educational technologies that includes expert assessment at four consecutive hierarchical levels. The final product is the priority series of evaluated objects taking into account weights of the experts and relative weights of evaluating criteria. Figure 1 presents the proposed algorithm of expert evaluation of educational technologies:

1. First, experts should be assigned some ranks. It is reasonable to utilize the peerreview-assessment procedure, i.e. each expert numerically evaluating qualifications of all other colleagues. Each expert receives a weight reflecting his or her competence level. Then self-ranking takes place. Such expert evaluation has two specific features distinguishing assessment of expert qualities from the assessment of qualities of other objects. The first feature is that an expert's rank may be characterized not only by the scores of fellow experts but also by self-ranking, by the difference between self-ranking and scores given to an expert by other experts, and by the impact of self-evaluation on the overall expert's rank. The second feature distinguishing assessment of expert qualities from the assessment of qualities of other objects is that after ratings of all experts are computed, it is reasonable to take into account their ranks to adjust their evaluations of each other. It is logical to assume that scores by higher ranking experts should have higher weights. This stage results in a prioritized sequence of experts.

2. Second, experts assess the relevance of criteria used for evaluation of objects of

expertise. This stage results in a prioritized sequence of the objects of expertise (educational technologies). Creating this series takes into account relative weights of experts.

3. Experts evaluate the objects of expertise. Objects to be evaluated in the course of an expertise can be compared in a pair-wise manner, or they can be assigned numeric weights, or else they can be placed in a hierarchical quality-level sequence. This creates priority series for each evaluated trait of each object.

4. The program automatically creates the final priority series of evaluated objects taking into account weights of experts and relative weights of evaluating criteria.

Currently, we are developing the software allowing, through a meeting in a computer class, to obtain results of expert evaluations immediately. It is also possible to conduct expert evaluations via the Internet, in which case the resulting score is formed gradually as experts answer the questions.

V.F. Torosyan

#### COMPARATIVE ECOANALYSES OF QUALITY INDICATORS OF WATER AND THE FACTORS OF TECHNOGENIC INFLUENCE UPON THE OBJECTS OF HYDROSPHERE

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Water is a unique material with extremely valuable properties that guarantee the existence of living organisms on the Earth, providing their life-sustaining activity.

Kemerovskaya oblast with its 4% of West Siberia territories is an industrially developed constituent unit of Russian Federation. Quality of an open water of river Tom, which is the main waterway of Kuzbass, has been influencing by hydro chemical composition of subsoil waters, overland runoffs from farm lands, forests, human settlements, and rainfalls.

Tom basin is a typical example of a territory with a high rate of urbanization and developed industry. Coal mining, machine building, chemical and metallurgical enterprises as long as human settlements, weapon ranges and domestic garbage dumps are located within the outfall of Tom.

Natural property of Tom has been currently changed due to industrial and sewage pollution. Self purification capability of water has been decreased.

To evaluate the quality of water of the river Tom the water pollution mark, i.e. an integrated index of 13 ingredients that takes into account specific features of urban industrial enterprises was used. The pollution mark has revealed the increase in anthropogenic stress and tendency towards the growth of ferrum and manganese content.

From our point of view ash disposal areas of metallurgical enterprises produce their technogenic influence upon the objects of hydrosphere. Therefore one of the tasks of the research was to reveal a kinetic interaction between ion content in ash disposal areas of Yurga machine building plant's metallurgical shop and their penetration into the water of Tom.

Chemical composition of ash is an important characteristic that helps to evaluate a hydraulicity of ash. To determine its ecological danger we have carried out a research that helped to determine the emission of  $Mn^{2+}$  and  $Fe^{3+}$  heavy-metal ions in the model water environment. Water environment is: 300ml of  $H_2O$  dstd, 150g of ash and 300ml of ammonium acetate buffer CH3COOH+CH3COONH4 (acetic acid and ammonium acetate) pH=4,8 that was an imitator of an excited environment, and 150g of ash. The experiment was being carried out in a static condition. Ash disposal water extract is characterized by the alkaline reaction of the environment (pH= 9,5-12,5), high general mineralization. A method of photocolorimetry was applied to carry out a quantity analyses of  $Mn^{2+}$  and  $Fe^{3+}$  ions emission in the solution. It has been stated that hard-metals' desalination in distilled water comes to its extreme.

Counting on the amount of emission reaction speed constant of materials under research into the buffer following the

$$K = \frac{1}{t} Ln \frac{C_0}{C}$$

formula, we made sure that the amount of speed constant we had received does not differ much. As a result we can state that the hard-metals' emission in a buffer follows a kinetic dependence of the first order, while  $Mn^{2+}$  emission speed is higher than that of Fe<sup>3+</sup>.

Yu.A.Treger

#### TECHNOLOGY ISSUES IN PRODUCTION OF UNSATURATED ORGANOCHLORINES (CHLOROLEFINS)

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The most widely produced and used chlorolefins include:

• vinyl chloride (VC), monomer for production of polyvinyl chloride (PVC);

• vinylidene chloride (VDC), monomer for production of polyvinylidene chloride and a number of copolymers;

• trichlorethylene (TCE), a solvent for metals degreasing;

• perchlorethylene (PCE), a solvent for dry cleaning of clothes, metals degreasing, and raw material for production of certain freons;

• allyl chloride (AC), a raw material for production of epichlorohydrin, allyl alcohol;

• chloroprene (CP), a raw material for production of chloroprene rubber.

The methods for chlorolefins production are well studied and successfully used in the industry for many years. However, the production of certain chlorolefins faces a number of problems unsolved so far. Typically these are environmental issues, primarily related to organochlorine wastes, but sometimes these issues are of technology nature.

One of the ways for settling the issues of organochlorine waste is an oxidative chlorination

giving TCE and PCE. The process has been worked out in the experimental scale and could be a reasonable alternative to thermal disposal (incineration), where hydrocarbons raw materials, including in the most cases chlorohydrocarbons, are irrevocably lost.

Additive oxidative chlorination may be used in the VDC production via thermal dehydrochlorination of 1,1,2-trichloroethane. Symmetrical dichloroethylenes obtained in this process are chlorinated up to 1,1,2,2 - tetrachloroethane, which is the raw material for the production of trichlorethylene and/or perchlorethylene.

Another example is the production of chloroprene from butadiene. One of the problem and limiting stage is the isomerization of 1,4-dichlorobutene into 3,4-dichlorobutene. The exclusion of this stage with target separation of 1,4-dichlorobutene and its further processing into 1,4-butanediol may improve the chloroprene output efficiency and at the same time give a valuable on-demand product.

#### I.I. Ustinova

# ELECTROMAGNETISM IN THE ECO-DYNAMICS OF URBAN AREAS

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In the course of studying the properties and mathematically describing the trends of the development of urban areas as environmental and urban planning systems (EUPS), we've revealed the similarities in the frequency of changes in the basic parameters of the system (i.e. the demographic capacity (C) population (P), population dynamics ( $\Delta$ P)) and other physical quantities of the wave nature. It would seem that the pendulum swings do not resemble the capacitor discharge through the inductor, and much less the eco-dynamics of development of urban areas. However, basing on the results of the study, mechanical, electromagnetic and urban and ecological quantitative processes obey the same quantitative laws. The aforementioned can be observed if one is interested in not what changes: load on the spring, the electric current in the circuit or the population of the region, but in how these changes happen. Analyzed similarity is not related to the nature of values, which change periodically, but to the very processes of their change (Table 1).

As it is known, the electromagnetic waves exist only because the changing magnetic field generates an alternating electric field, which, in its turn, generates an alternating magnetic field. In accordance with the laws of ecosystem self-regulation, each region has a certain demographic capacity, the reserve of which determines its increase, while its lack causes the reduction in the size of its population. With population growth, the region's capacity becomes exhausted (natural capacitor discharges), while the number and attractiveness of the cities grows. It is a kind of transformation of the potential energy of the territory i.e. the electric field energy into the utilized energy of urban development i.e. the energy of the magnetic field of EUPS. Consequently, the total energy of the EUPS will be equal to the sum of its potential and utilized energy (see Table 1):

Mechanical	Electrical quantities	Indicators of EUPS	
mass (m)	inductance (L)	population (P)	
coordinate (x)	charge (q)	capacity = maximum number of stable population (C=P <sub>m</sub> )	
speed $(v_x = x')$	current $(i = q')$	population dynamics $(\Delta P \text{ or } P')$	
acceleration (a <sub>x</sub> = x")	electromagnetic waves in the circuit (q"= - q /LC)	growth-rate decline $(\Delta P' \text{ or } P'')$	
elastic force (F <sub>x</sub> = -kX)	resistance circuit (R)	environment resistance (1 –P/C)	
spring stiffness (k)	reciprocal capacity (1/C)	stiffness of environment (1/C)	
potential energy (k x²/2)	electric field energy (q <sup>2</sup> /2C)	potential «electric» energy (C/2)	
$\frac{\text{momentum}}{(\text{mv}_x^2/2)}$	energy magnetic field (Li²/2)	implemented «magnetic» energy $(P_{\Delta} P^2/2)$	

Table 1. The analogy between indicators of environmental and urban planning systems (EUPS), mechanical and electrical quantities

W=  $H_{\Lambda} H^2/2$ + E/2=  $E = H_{\Lambda} H_m^2/2$ .

The revealed analogies prove that the environmental problems of urban areas constitute one of the stages in the life cycle of EUPS seeking to equilibrium i.e. the aim and end of a particular cycle of development, which can last during an unidentified period of time before a new cycle. In eco-dynamics of the region, as in any changeable process, there is no criterion of the "best" one, but there is only a change in the rhythm of states, the greater or lesser intensity, speed and direction of development. In physical sense, the phenomenon of the EUPS self-regulation is comparable by its importance with the phenomenon of electromagnetic induction.

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#### CERAMIC FILTERS WITH CATALYTIC COATINGS FOR NEUTRALIZATION OF INDUSTRIAL EXHAUST GASES

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Inorganic porous materials possessing the unique properties in comparison with polymeric ones are of technical importance for separation and filtration processes as well as for catalytic purification. These materials are characterized with high thermal and chemical stabilities, long operating life and so on. The application of highly porous ceramic materials with supported catalytically active layer for high-temperature neutralization of industrial exhaust gases is of great interest. Studies have shown that alumina, titania and such aluminosilicates as mullite and cordierite would be good candidate materials for the manufacture of ceramic filters and membranes.

In this work the method for microporous permeable ceramics production from natural raw materials of Komi Republic was developed. Both pore size in the range of 1-30  $\mu$ m and permeability was controlled by varying the ratio of initial components. Cordierite ceramic was prepared from kaolin, bauxite, talc, alumina, and silica sand. Kaolin ceramic was obtained by introducing the burnable additives based on various cellulosic materials into mineral charge. The use of natural sources for ceramic synthesis allows us to reduce the cost of resulted products.

The method of surface self-propagating thermal synthesis was adapted to form the catalytically active layer on the surface of microporous ceramic support. The high activity of the synthesized  $CuO-Co_3O_4-CeO_2/kaolin$  and  $CuO-Co_3O_4-CeO_2/cordierite$  catalytic membranes was shown to be caused by even distribution of highly dispersed active components both on surface and in the bulk of microfiltration ceramics (Figure 1).



Fig. 1. SEM images of microporous ceramics: initial (a) and after supporting of catalytically active layer (b)

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#### INDUCTION PERIOD FOR ALKYLAROMATIC HYDRO-CARBONS' AIR OXYDATION PROCESS IN THE PRESENCE OF TRANSITION METALS' SALTS

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Liquid-phase catalytic oxidation of **a**-C substituted aromatic compounds is one of the most promising and practically significant routes for synthesis of the respective oxygencontaining derivatives. In the present study an investigation of the induction period kinetics for the process of liquid-phase air oxidation of alkylaromatic compounds (xylene isomers and ethylbenzene were used) was carried on. The highest liquid-phase oxidation process rates possible can be achieved when transition metals' salts (Co(II), Mn(II)) catalysts are utilized, mixed systems being the most effective. Oxidation of xylene isomers is one of the major routes for obtaining phthalic acids, which in their turn are widely used for the production of polymers. Therefore, investigation of xylene isomers, i.e. o-xylene, is an important and timely topic.

Much research on liquid-phase alkylaromatic compounds' oxidation done up to date was devoted solely to individual cobalt-based catalysts. A kinetic model of the process was proposed, its elementary stages were isolated, and protocols for chromatographic analysis of the main, side, and intermediate products of the process were developed. All of the suggested mechanisms were supported with the respective kinetic models, which are shown to be adequate even at high conversion ratios. The initial period of the catalystassisted liquid-phase oxidation of alkylaromatic compounds has never before been studied. Developing of kinetic model of this stage of the process will offer a possibility to propose an adequate kinetic model of the process of liquid-phase oxidation of the alkylaromatic hydrocarbons using the initial concentrations instead of the current ones.

In the process of non-catalytic oxidation the main source of the radicals that drag carbon into oxidation is the thermal decomposition of hydroperoxides. In the presence of the metal ions the role of hydroperoxides is the generation of catalyst metal's highest valence state; in this case, hydroperoxides do not serve as an additional initiation source. Formation of free radicals occurs as a result of Co(III) and alcohol interaction; precisely this reaction initiates the process.

Induction period means time needed for formation and accumulation of the active form of the catalyst. Oxidation process is usually studied at such conditions that transition time of Co(II) to Co(III) is too small for its kinetics to be investigated. However, it is critical for the development of the united kinetic model for alkylaromatic hydrocarbons' oxidation; therefore, conditions in our study were chosen in such a way as to allow the kinetics of the induction period to be investigated.

In the present study we report the influence of initial compound, intermediate

product, catalyst concentrations, gaseous oxidant flow rate, reaction temperature and other parameters on the kinetics of alkylatomatic hydrocarbons' oxidation in the induction period

S.M. Vetvitskaya

#### INTEGRATIVE APPROACH TOWARDS THE PROBLEM OF ECOLOGICAL EDUCATION

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Ancient people of wisdom said: "Know yourself and you'll know the world!" But every time coming across a problem people try at first to look for its solution in the outside world, trying to change the world. And only later when they realize the hopelessness of this approach they start analyzing the inner world. The history of the ecological crisis research counts nearly one hundred years, but only lately people have realized that ecological crisis is a crisis of world outlook, a philosophe-ideological crisis. In order to solve ecological problems on a global scale people should change the current anthropological attitude which makes a man and his interests the centre of the universe.

Technological development, misappropriation of natural resources, elimination of animals, environmental pollution – all this has led to deposit reserve depletion and made the mankind face a global ecological crisis. It's become evident that we need new guidelines which don't put a man in opposition with nature. To establish good interrelations with natural processes that provide steady maintenance of life on our planet we need to follow the laws of creation and active operation of biological systems included in the global turnover.

The global ecological crisis makes us clear up what relations of human and nature can be considered balanced, how human activity influences the environment and why ecological culture is of such great importance especially today. It's necessary to note how the level of ecological culture is connected with the world state matters, how it correlates with the global ecological crisis. Owing to this it's important to state that the level of ecological culture is directly proportional to ecological situation in the world and is directly proportional to the perception of biosphere.

Ecological education is the most important component of world culture, persistent process of cognition and transformation of environment. The initial phase of ecological education is a personality showing special attitude towards nature and spirituality. Spiritual content doesn't function independently but it's put over the natural and is interpreted through it. But the value of individual depends on how objective it is. Ecological culture is the level of environmental perception, consciousness of person's position in the universe. Ecological consciousness is traditionally defined as a complex of ecological images in the interrelations "a man – nature" and nature itself, the existing attitude to nature as well as corresponding strategies and technologies of interaction. The established type of ecological

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consciousness determines human's behavior towards nature.

Today the study of integral individuality is quickly developing. It's become an important mechanism of integration of human sciences and the foundation in solving unique problems of modern human studying.

Besides, integral individuality is a universal formally-contextual regulator of human behavior. V.S. Merlin stressed a particular meaning of integral individuality in social practice. "The solution of any practical task" wrote he, "connected with a man will be successful only in case we take into account all the variety of conditions determining a person's activity as well as the variety of individual characteristics of different hierarchical levels which influence this activity." (V.S. Merlin, 1986, p.27)

S.V. Vitrishchak N.V. Kachur O.L. Savina G.V. Klimenko I.O. Pogorelova S.Yu. Gavrik

## SANATORIUM AND HYGIENIC ASPECTS OF SANATORIUM-RESORT TREATMENT OF DISEASES OF THE MUSCULOSKELETAL SYSTEM IN THE RESIDENTS OF AN INDUSTRIAL REGION

SE «Lugansk State Medical University», Lugansk

Physical medical factors plays a significant role in the prevention and rehabilitation treatment of various diseases. They are regarded as adaptogens and help to restore violations of the internal environment of the body. According to the theory of the adaptive action of resort, the normalization of mechanisms of homeostasis is achieved on the basis of functional adaptation, which is caused by a combination of the positive impact of various physical factors on the functional systems of the body so that the normalization of one of them helps to restore another. Physical factors, depending on the physical nature and the type of impact on the body can be conditionally divided into three big categories: thermal, mechanical and electromagnetic. Physical factors should be attributed to the basic therapy for diseases of the musculoskeletal system of workers in the industrial region (miner, metallurgists, mechanical engineers). Due to their effects there are stimulation of neurohumoral, metabolic and trophic processes.

The main objectives of sanatorium and resort treatment of patients with rheumatoid arthritis are the restoration and correction of functions of the musculoskeletal system, prevention of exacerbations, and self-service instruction for handicapped persons. Sanatorium and resort treatment of deforming osteoarthritis aims to eliminate the external factors that contribute to the progression of the disease, reducing pain, secondary synovitis, restore joint function.

Pelotherapy, mud therapy is used, when the activity of the inflammatory process in the joints decreases, neurohumoral regulation is restored, the general condition of the patient is improved. Mud procedures are appropriate for patient with the productive

inflammation of the joints, chronic synovitis, marked trophic changes in the presence of contractures and deformities. When balneo reaction is appeared we should to cancel the procedures, to connect medication therapy, procedures electromagnetic field of millimeter range. To renew the mud therapy we use light procedure and only after the disappearance of inflammatory manifestations. The most common mineral baths are hydrogen sulfide, sodium chloride, iodine-bromine, radon.

Physiotherapy techniques take one of the leading position in the whole complex of sanatorium and resort activities: electromagnetic fields, inductothermy, procedures with ultra-high frequency therapy, procedures with ultrasound, low frequency pulsed current, sinusoidal modulated currents, interference currents, iontophoresis, laser therapy. We prescribe it taking into account the stage of disease, accompanying disease, age of the patient. With the help of apparatus physiotherapy we can influence the recovery of metabolism, microcirculation, reduce symptoms of pain syndrome and restore joint function.

Medical gymnastics and massage occupy a leading position in the sanatorium and resort treatment of the industrial enterprises' patients. Medical gymnastics has a positive effect on the metabolism, improves the function of the musculoskeletal system, increases joint mobility, counteracting the development of contractures and ankylosis, strengthens muscles, ligaments, improves blood circulation, respiration, and reduces pain. Medical gymnastics in water (in swimming pools), swimming by special techniques have very good results.

Thus, sanatorium and resort treatment of residents of the industrial region, patients with diseases of the musculoskeletal system (inflammatory or trophic nature), should be complex. Therapeutic and rehabilitation complex is formed on the basis of diet therapy, medical gymnastics, massage, local natural medicinal factors, apparatus physiotherapy, psychotherapy, etc.

S.V. Vitrishchak V.V. Zhdanov E.L. Savina E.V. Sanina E.V. Sichanova S.A. Svetlichnaya L.I. Frolova A.K. Klimenko

#### PSYCHOLOGICAL FEATURES OF DEVELOPING THE ECOLOGICAL CULTURE OF AN INDIVIDUAL

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At all stages of a human development there has been a problem in the relationship between an individual, society and the nature.

At the same time, in the modern society more attention to ecological problems due to an emergence of a serious ecological problem of a human nature that causes a targeted qualified ecological training of youth with a high levels of formed common culture, including ecological one. The objectives of our theoretical research - to examine the status of the problem of the ecological culture of an individual.

The ecological culture can be seen as a spiritual state of a society and individuals, which is due to the historical and pedagogical factors and determine the format of interaction with nature in the field of cognition and action.

Today, the people's attitude to nature requires them to at least a minimum of ecological culture, and for person's learning ecological culture, it requires not only knowledge and skills but also the development of the capacity to orientate in the flow of ecological information, certain behaviors and activities.

A logical and methodological analysis of the essence of ecological culture as a personality traits shows that ecological culture is a combination of material and spiritual values created by the man in the field of ecological education, as well as some experience in ecological activities, emotional and value attitude to nature. At the same time, the concept of "ecological culture" includes procedural and productive side of this activity, because ecological culture is fixed and manifested in the values and traditions passed down from generation to generation.

The analysis of the concept of "ecological culture" allows you to select in its structure some interconnected and interacting components and ecological culture can be considered as an integrated system consisting of a number of interrelated elements:

- the system of knowledge: natural and scientific, ecological, valuative, normative, practical;

- the ecological consciousness and thought, including the determination of cause and effect, prognostic and other links;

- the system of practical skills that determines the level of practice;
- the culture of feelings that characterizes the emotional level of human activity;

- the culture of ecologically sound behavior, characterized by the degree of transformation of ecological knowledge, consciousness, thought, and culture of the senses in everyday normal act.

The successful formation of ecological culture depends on how deeply the children, teenagers, students covered in activities aimed at the creative implementation of the ideal image of nature.

Thus, different types of activity can actually see the ecological problems and actively put into practice the ecological knowledge and skills. A gentle, humane, responsible attitude to nature is a kind of indicator of ecological culture, the formation of which is one of the tasks of the spiritual and moral upbringing of the younger generation, as the basis of the state. S.A. Volkov

#### FIBERGLASS PIPES MARKET DEVELOPMENT IN RUSSIA AND THEIR APPLICATION IMPACT ON ENVIRONMENT IMPROVEMENT IN OIL PRODUCTION AREAS

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Russian oil production areas are considered as elevated ecological hazard related to natural processes direct intervention. We will not concern safe technologies and production methods, but let's recap on an important issue, the environmentally-green materials application such as fiberglass with high reliability and resistance to corrosion – main antagonist of traditional materials.

Fiberglass in oil industry is, above all things, pipes and tanks.

Our experience demonstrates that the consumer is primarily motivated by economic considerations when choosing the material. For the entire lifecycle fiberglass linear pipeline gives six-time economic effect and only once fiberglass was opted, namely from ecological reasons, for pipeline lying in drinking water field protective zone.

Hence, the first conclusion is that not only the economical and technological culture development, but also ecological awareness of oil producers is of a great importance, as the main risks from their activities are fresh water supply pollution and soil contamination.

Fiberglass advantages are: absolute resistance to oil field aggressive environment and high reliability that is why in the existing up-today practice in Russia and CIS these pipes are in most common use for reservoir pressure maintenance system, since there are no thoroughly reliable corrosion protection methods for steel pipes from extremely aggressive process liquids in the system. More cautiously these pipes are exploited in oil production. First wells, complicated by tubing corrosion, were provided by fiberglass pipes for oil fields, belonging to OAO "Rosneft". These sorts of wells, as a rule, are distinctive for heavy and sour oil fields. The practice has proven high effectiveness and correctness of those decisions.

During linear pipeline erection works we implement an approach "Dig and Forget". Actually fiberglass pipes are designed so that their life cycle exceeds the oil field life cycle. Practice confirms this concept, as in some deposits even roads have been decayed, along which the traditional pipelines periodical inspections with respect to probable leakage were processed. For sure there is an external pipe damage risk, since underground search using conventional methods is extremely difficult, so the requirement of global positioning system such as Glonass and good as-built documentation keeping is of a great importance.

Another important fiberglass quality is that there is no contamination by radioactive metal salts, containing in the oil fields reservoir. Let me remind you that a great number of these pipes are hold in special polygons and many of them are corroded so much that it is impossible to transport them for utilization. Pipe utilization itself is extremely expensive and

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if we add the utilization cost to life cycle cost then fiberglass pipes are appeared to be cheap. In general, composites application in Russia has a bright future, though implementation process is quite slow, but this is the Russian tradition and this is the Russian mentality.

L.D. Volkova N.A. Zakarina O.K. Kim

## MODIFIED KAOLINITES IN SORPTIONAL PURIFICATION OF WASTE WATERS FROM CATIONS OF HEAVY METALS

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The Republic of Kazakhstan, possessing the big territory, constantly suffers from water deficiency. Therefore questions of water purification are important for the country.

It is known that one of the major factors influencing process of sorption water purification from cations of heavy metals, are physical and chemical characteristics of sorbents. Montmorillonites, for example possessing high adsorptional ability, swell in water, prevent a filtration.

Natural kaolinites are represented great interest as sorbents of heavy metals ions. Results of tests of water purification from cations of heavy metals (Fe<sup>3+</sup>, Ni<sup>2+</sup>, Cr<sup>3+</sup>, Zn<sup>2+</sup>) at their joint presence on the best samples of modified kaolinite clays are presented in work.

Modifying of acid treated kaolinites are carried out by hydroxocomplexes of aluminum, iron and the titan. After treatment materials washed out, formed in granules, dried up and calcinated at 500°C. It is used 5 cm<sup>3</sup> of the sample. Quantitative definition of metals cations at their joint presence is carried out by method of nuclear and absorbing spectroscopy with using of nuclear adsorption spectrometer AAS-1N Karl Zeiss (Jene), separated cations – by the certificated techniques by photo colorimetric method (FEK-3). Concentration of each of cations in the modeling mixed and individual solutions was about 2 mg/dm<sup>3</sup>.

Passed capacity of synthesized AlHKS, FeHKS and TiHKE – sorbents during 1,2,3,5,7 and 9 hours is determined. Among the studied samples kaolinite clays FeHKS has the greatest capacity (0,3 ml/min). It is shown that the purification is the most effective for Fe<sup>3+</sup> and Cr<sup>3+</sup> ions on all studied kaolinites. Ions of Zn<sup>2+</sup> and Ni<sup>2+</sup> - cations further follow. For the solutions containing 1 cation degree of purification, which is equal to 90-95 %, does not change during 9 hours. At joint presence of all cations in model solution high degree of purification 94 – 96,6 % is observed for Fe<sup>3+</sup> on all studied sorbents. Purification from Cr<sup>3+</sup> and Ni<sup>2+</sup> ions fluctuates during 9 hours in limits 79,3 – 98,4 % for TiHKS and AIHKE – contacts. AlHKE – contact is the most effective (96 %) in purification from Zn<sup>2+</sup> ions.

Regeneration of adsorbents was carried out in two ways:

1. The samples were washed with water (method 1).

2. The samples were washed with water and calcined in air at 500°C (method 2).

The advantage of the regeneration by method 2 is the increasing of the rate of supplying solution through sorbents. Sorbents can withstand space velocities up to 5 ml/min. Swelling

of them after the heat treatment by the regeneration method 2 does not occur, which significantly increases the rate of wastewater treatment. The methods of regeneration of sorbents are designed which allow to use them many times.

Thus, the developed sorbents can be used for waste waters treatment from ions of heavy metals at their joint presence that it was confirmed at waste waters purification of the industrial enterprises of Pavlodar city.

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## REHABILITATION OF RADIOACTIVE CONTAMINATED AREAS

: Ural federal university, Ekaterinburg

Incidents on nuclear fuel cycle enterprises lead to contamination of territories, farming fields and water areas. Such long-living radionuclides as <sup>137</sup>Cs and <sup>134</sup>Cs make a major contribution to such contamination in the long term. Some

cheap and available sorbents can be used in rehabilitation activities for decontamination of large volumes of radioactive contaminated water (including drinking water), prevention of radionuclides migration into ground and surface waters through soil, returning of contaminated soils to farming industry. If high caesium activity is present in natural water a high decontamination factor will be required; in case of soil contamination high retention efficiency of radionuclides will be required to prevent their migration into vegetation and further movement through food chains. Therefore, the most important characteristics of sorption materials are specificity, measured as distribution coefficient  $K_{a}$ , selectivity and irreversibility of sorption.

A comparative study of caesium sorption by clinoptilolites from Shivyrtooinsky (Chita region, Russia) and Dzegvi (Georgia) deposits, quartz-glauconite concentrate from Karinskoye deposit (Russia), zeolite from Sibai deposit (Bashkortostan, Russia), vermiculite (Russia) and manganese greensand (glauconite sand, USA) and also surface-modified sorbents based on glauconite and clinoptilolite is made in this work. The assessment of possibility of use of natural and modified aluminosilicates for rehabilitation of radioactive contaminated territories is made.

Researches have shown that surface-modification of natural aluminosilicates (clinoptilolite and glauconite) allows to improve distribution coefficients of caesium in up to 10-100 times. For example, distribution coefficients of caesium for mixed nickel-potassium ferrocyanide on clinoptilolite reach up to  $(2.2 \pm 1.2) \cdot 10^6$  mL g<sup>-1</sup>.

Selectivity and chemical stability of natural glauconite and mixed nickel-potassium ferrocyanide on glauconite were studied. It is shown that does not possess caesium selectivity so interference of sodium becomes apparent at concentrations of 0.01 mol·L<sup>-1</sup> and higher; interference of potassium appears at any studied concentrations. Meanwhile,

the interference of sodium to sorption of caesium by surface-modified glauconite is almost absent. Potassium shows interference to sorption of caesium by surface-modified glauconite at concentrations of higher than  $0.01 - 0.1 \text{ mol}\cdot\text{L}^{-1}$ , though distribution coefficients of caesium on modifed glauconite remain considerably higher than those on natural glauconite. However, potassium is usually present in natural waters at significantly lower concentrations than sodium with the average potassium concentration of up to  $0.01 \text{ mol}\cdot\text{L}^{-1}$  in sea-water and rather lower (100-1000 times) in fresh and ground waters, therefore in real situations potassium will not show interference to caesium sorption by surface modified aluminosilicates.

The study of chemical stability saturated by radiocaesium natural glauconite show, that high caesium leaching rates and degrees are typical for natural glauconite irrespective of leachant salinity. Total degree of leaching after 35 days of leaching was: mineral water = 63.4%, tap water = 41.6% and rain water = 28.8%. Thus, it could be expected that there will be no reliable retention of caesium by the solid phase after addition of the natural aluminosilicates into soil. In contrast to natural glauconite, the modified glauconite shows rather better results with the total degrees of leaching under the same conditions of: mineral water = 1.5%, tap water = 14.6% and rain water = 6.6%.

Thus, surface modified glauconite can be used for rehabilitation of soil and water contaminated by radiocaesium. However, it is needed to take into consideration that under using for rehabilitating contaminated agricultural land will be some limitation of the amounts of inorganic potassium and ammonium fertilizers being used.

N.A. Zakarina L.D. Volkova

# MODIFIEDNATURALMONTMORILLONITESAND KAOLINITESFOR THE SYNTHESIS OF HIGH-OCTANENON-POLLUTINGADDITIVES TO MOTOR FUEL

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Problems of ecological safety and protection surrounding environments raised the requirements to quality of fuels and technologies of their production. In this regard process of a skeletal isomerization of light n-alkanes with formation of the branched-out isomers has the increasing value for production of non-polluting high-octane components of motor fuels.

Thanks to introduction of high-octane isoparaffin in gasoline there is a possibility to improve ecological characteristics of gasoline and to lower the content of benzene, aromatic and unsaturated hydrocarbons in automobile fuel.

Objectives of this work is the realization of the applied investigation in the field of environmental protection by means the creation of effective catalysts on the base of

Kasakstan natural clays for the processes of isomerization of n-alkanes to the branchedout isomers with high octane number.

The methods of synthesis pillared Tagan montmorillonite (Ca– and Na– forms) and Pavlodar kaolinites (Ermakov and Sarymsak deposits) by Al<sup>3+</sup>, Zr<sup>4+</sup>, Ti<sup>4+</sup> and Fe<sup>3+</sup> cations were developed.

Phase composition of studied clays was determined by XRD method. The expansion of aluminosilicate layers of NaHMM and CaHMM at the pillaring by  $Al^{3+}$ ,  $Zr^{4+}$ ,  $Fe^{3+}$  and  $Ti^{4+}$  was found. Base reflexes of MM, KS, KE are conserved at the acid activation and pillaring by  $Al^{3+}$ ,  $Zr^{4+}$ ,  $Ti^{4+}$  and  $Fe^{3+}$ . The content of alkaline components (Na<sub>2</sub>O, K<sub>2</sub>O, CaO) decreases and reflexes of respondent oxides:  $Al_2O_3$ ,  $Fe_2O_3$  (hematite),  $TiO_2$  (anatase),  $ZrO_2$  are appeared. The appearance of these oxides was confirmed by the results of elemental analysis.

Significant growth surface area and total volume pores of samples after acid treatment and pillaring by  $Al^{3+}$ ,  $Zr^{4+}$ ,  $Ti^{4+}$  and  $F^{e_{3+}}$  ions was found by BET method

The reaction of n-hexane isomerization were tested in the reactor of flowing type under atmospheric hydrogen pressure at the temperatures of 250-400°C, over 5 sm<sup>3</sup> of the catalyst, an n-hexane space velocity of  $0.82h^{-1}$  and reactant mole ratio of H<sub>2</sub>:  $n-C_{c}H_{14} = 3.5$ .

The optimum compositions of Pt- and Pd-catalysts supported on the pillared clays, in which n-hexane at 300-400°C isomerized to isohexanes with a minimum content of products of hydrocracking were choose.

Selectivity to isomers for the best catalysts hesitates in the range 93.3-100%. Maximum conversion of n-hexane which is equal to 62.5% with selectivity to isomers equal 100%, was observed on 0.35% Pt/TiCaHMM-catalysts at 300°C. The conversion of n-hexane over studied catalysts with 100% selectivity to isomers decreased in row: Pt/TiCaHMM (62.9%) > Pt/FeHKE (59.1) > Pt/AlNaHMM (58.1%) > Pd/AlNaHMM (51.8%).

The work is partially supported by ISTC (project No K- 1476)

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#### STUDYING ANTIMICROBIAL ACTIVITY OF SOME SURFACTANTS FOR THEIR PROSPECTIVE USE AS THE COMPONENTS OF NANOSTRUCTURED SORBENTS

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Currently, environmental biotechnology has increased the demand for different sorbents used for contaminated soil and wastewater treatment as well as for cleaning gas emissions of industrial enterprises. Using biologically active organic bentonite including its nanostructured variety as an adsorbent proved to be very effective.

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Organic bentonite is a product of interaction of natural montmorillonite clays with quaternary ammonium salts (QAS). In this particular case, its crystal structure is layered, and nanospaces are present in the system between elementary plates of aluminum silicate. Polymer molecules or bactericidal compounds containing SEPTAPAV (didecyldimethylammonium chloride), ALKAPAV (alkyltrimethylammonium chlorides C12-C14), KATAPAV (alkylbenzyldimethylammonium chlorides C12-C14) can be easily embedded in these nanospaces.

Simultaneous removal of ecotoxicants and pathogenic microorganisms from wastewaters is one of the key problems today. In this context, the goal of our study was:

- To investigate antimicrobial activity of various surfactants;

- To select the most promising surfactants for constructing chemical compositions with the nanostructured organic bentonite.

We explore various options for surfactants: SEPTAPAV, ALKAPAV and KATAPAV. SEPTAPAV is a cationic surfactant with fungicidal properties. Some authors recommend using it as tuberculocide. It is actively used in oil and methane gas production.

ALKAPAV is used as the basis in compounds for wood preservation. It is also used for water treatment, and as an active additive in the production of technical detergents and household chemical goods. It has fungicide, antistatic and conditioning properties.

KATAPAV is a cationic surfactant with tuberculocidal and fungicidal properties. Being one of the components in wood preservatives, it is also used for water treatment and as a functional additive in manufacturing of technical detergents, household chemical goods, auxiliary textile substances, paintwork materials, synthetic rubber, and compounds for leather and fur treatment.

We studied antimicrobial properties of these surfactants towards standard bioassay micro-organisms, Staphylococcus aureus 209 P and Escherichia coli M-17. For our experiments, we prepared 1% solutions of surfactants and suspensions of microorganisms in the physiological solution complying with the turbidity standard #10 specified by the Russian Federal Institute for Standards named after Tarasevich. We then diluted the suspensions up to the concentration of 500,000 microbial cells in 1 ml. After that, we were adding suspension of microorganisms into 1% solutions of surfactants with subsequent incubation of the mixture for 30 minutes at room temperature. After that we were separating liquid above the sediment from the mixture and adding it to nutritive medium optimal for bioassay microorganisms.

Our experimental results were based on conventional microbiological methods of counting number of colonies of microorganisms developing on nutritive medium. While our results confirmed bactericidal properties of SEPTAPAV and ALKAPAV towards used microorganisms, KATAPAV had neither bactericidal nor bacteriostatic impact on Grampositive staphylococci and Gram-negative rods. We therefore propose using SEPTAPAV and ALKAPAV in combination with a sorbent for bactericidal purposes.

#### euro-eco: hannover2012

F.V. Zaryaev L.V. Shulgina P.M. Glekov

# ENVIRONMENTAL ASPECTS OF INVESTMENT IN THE STEEL INDUSTRY

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The investment policy in the industry means search of optimum ways of updating and upgrade of manufacture for a sustainable development of the enterprises. Ferrous metallurgy represents the export-focused raw branch, and Russia takes leading positions in Europe and the world on volumes of production of this branch: for example, the third place on manufacture and pig-iron export as bases of manufacture of a steel. The ferrous metallurgy share in industrial output of Russia makes about 10 %. (Data of the website of Prime Minister of Russia, on July, 24th 2008).

However in this sphere there are the factors limiting steady growth of manufacture and influencing ecological conditions. It is possible to carry moral and physical deterioration of the equipment, reduction of internal consumption of metals because of stagnation in machine-building, customs barrier at export of production to the developed countries, the out-of-date technologies providing the high maintenance of toxic agents at emissions to atmosphere of by-products of metallurgy, the limited quantity of clearing filters at the smelting of a product of the first redistribution in metallurgy - cast iron.

Iron and steel industry development is a basis for growth of well-being of the population of the country. The ferrous metallurgy structure joins more than 1,5 thousand enterprises and the organisations, 70 % of them — the city-forming, the number of employees - more than 660 thousand people. By data of 2008, Russia takes the 4th place in the world on steel manufacture (72 million tons a year). By data of 2007, Russia takes the 3d place in the world (after China and Japan) on export of steel production (27,6 million tons a year). (Data of the Site of the Prime Minister of Russia, on July, 24th 2008). Metal manufacture influences the change of ecological conditions in any region as industrial complexes are city-forming enterprises around which the residential zone for workers and members of their families is created.

Therefore the investment policy for Metal manufacture should take into consideration the manufactures peculiarities indicated above and to include measures to prevent them. The iron and steel industry creates the big problems for ecology, namely: development of one ton of steel is produced of three tons of raw materials. Thus blast-furnace slags are on the regional and municipal lands, creating obstacles for their target use. As an example, the Urals region, where such waste in piles is stored more than 6 billion tons. The water used in metallurgy, pollutes groundwater, rivers, destroying live organisms in them. Atmospheric emissions include about 25 % of a metallic dust and oxide of carbon, and also – sulphur oxides. Thus, according to the statistics, "Norilsk Nickel" emits about 1 million tons of sulfur per year. Benzopyrene, fluoride, chromium compounds and manganese also go into the atmosphere, causing pathology in the health of inhabitants in the regions of metallurgical

manufacture. We believe that the investment policy - the ratio of the state as a subject of the economy to investment actions of other market participants, aimed at the creation of investment attractiveness, which should result in sustainable development of enterprises in respective areas.

We consider that the aspect of a sustainable development is connected with preservation of an environment and multiplication of resources for the future generations.

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#### EINFLUSS DES FÜLLMATERIALS AUF DEN FEUERWIDER-STAND DER WÄRMEISOLIERBAUSTOFFE

Staatliche Technische Universität Irkutsk, Irkutsk

aktive Entwicklung modernen Die des Industrieund Privatbaumarktes sowie die Durchführung der Rekonstruktionsprojekte stellt immer strengere Anforderungen an die Sicherheit während der Nutzung der Gebäude und Bauwerke. In verschiedenen Branchen der Industrie, darunter auch in der Baubranche, werden immer mehr polymere Kunststoffe benutzt. In Russland, wie auch in der EU und USA, spielt das Problem des Brandwiderstandes der Bauteile sowie des Gebäudes eine wesentliche Rolle. In Russland gilt das Föderalgesetz Nr. 123-FZ vom 22.08.2008 "Die technische Anforderungen an den Brandschutz", der die Benutzung der entflammbaren Baustoffe begrenzt. In der EU und in der USA gelten entsprechend eigene Richtlinien, die die Anforderungen an Feuerschutz der Baustoffe festlegen (BS 5588-5:2004, DIN4102, ASTM E84).

Ein aktuelles Problem stellt heute die Verringerung der Entflammbarkeit der polymeren Kunststoffe dar. Meistens wird die Entflammbarkeit durch den Zusatz von entflammungshemmenden Stoffen gesenkt. Durch solche Zusätze aber steigen die Preise der Baustoffe deutlich an. Eine sehr aussichtsreiche technische Entwicklung in Sachen des Brandschutzes ist der Ersatz von einem Teil des Polymers durch ein billigeres anorganisches Füllmaterial. Zu solchen Füllmaterialien gehören die Abfallstoffe der Kohlenverbrennung auf Wärmekraftwerken.

Die Mitarbeiter der Staatlichen Technischen Universität Irkutsk haben einen wärmeisolierenden Stoff entwickelt, der aus Duroplasten und Asche der Brennstoffe besteht. Die Forschung lief mit der Unterstützung des internationalen Lehr- und Wissenschaftszentrums für innovative Ökologie "Baikal – Wasma".

Während der Untersuchung der Eigenschaften dieser Wärmeisolierstoffe haben wir den Einfluss der Asche auf die Entflammbarkeit und Feuerbeständigkeit der Baustoffe bestimmt. Um den Zusammenhang zu bestimmen benutzten wir Proben mit dem Aschengehalt von 25% und 50% sowie eine Probe ohne der Aschenfüllung. Die Untersuchungen wurden nach den Standards von GOST 21207-81 "Methoden der Untersuchung der Entflammbarkeit" sowie GOST 28157-89 "Methoden der Untersuchung der Feuerbeständigkeit" durchgeführt. Bei der Bestimmung der Entflammbarkeit der Polymerkunststoffe verringerte sich die Größe des zerstörten Teiles bei der Zunahme des Aschengehaltes von 0% auf 50% um 15,6%. Bei der Bestimmung der Feuerbeständigkeit verringerte sich die Flammengröße um 22,3%.

Die durchgeführten Untersuchungen und Versuche zeigen die Wirksamkeit der Verringerung der Entflammbarkeit bei minimaler Verteuerung der Baustoffe. Große Mengen an entstehender Asche in den Wärmekraftwerken liefern ein aussichtsreiches nicht entflammbares Zusatzstoff für die Bauindustrie. Unter diesen Bedingungen kann der entwickelte Polymer eine wirksame Lösung sowohl der ökologischen Probleme von Verwertung der Aschenabfälle als auch der Verringerung der Entflammbarkeit der Wärmeisolierstoffe darstellen.

Die Materialien wurden vorbereitet mit der finanziellen Unterstützung von Bildungsund Wissenschaftsministeriums Russlands sowie der staatlichen Förderungsprogramms "Wissenschafts- und Lehrmitarbeiter des innovativen Russlands" 2009 - 2013

E.V. Zelinskaya N.A. Tolmacheva V.V. Barachtenko V.E. Samorokov

# UNTERSUCHUNG DER EIGENSCHAFTEN VON EINEM MINERAL-KUNSTSTOFFPOLYMER AUS DER KOHLEASCHE

Staatliche Technische Universität Irkutsk, Irkutsk

Heute ist eine Vielfalt verschiedener Materialien in der Bauindustrie verfügbar. Der russische Markt und die Hersteller der dekorativen Baumaterialien bieten dem Kunden verschiedenste Warenkategorien an. Aber trotz der breiten Auswahl braucht der Markt immer neue Entwicklungen und neue Stoffe und ist für neue Produkte mit besseren Eigenschaften und geringerem Preis offen.

In der Staatlichen Technischen Universität von Irkutsk haben die Mitarbeiter der GmbH "Ökostrojinnovationen" die Technologie der Herstellung eines neuen brandfesten Baustoffes entwickelt, der im wesentlichen auf den Aschenabfällen der Wärmekraftwerke und den Abfällen der Kunststoffpolymere basiert. Die Benutzung der Überresten als Produktionsquelle bietet die Möglichkeit, Ressourcen einzusparen und dabei einen ökologisch unbedenklichen Baustoff zu entwickeln, der 25-30 % billiger als bereits verkaufte Analoga ist.

Unserneuentwickelter Stoffhat im Vergleichzuden üblichen Holzkunststoffpolymeren eine höhere Brandfestigkeit, bessere Wasserdurchlässigkeit, besseren Wärmedehnungskoeffizient und geringere Dichte.

Der Baustoff entspricht den modernsten Anforderungen der ökologischen Sicherheit und des Brandschutzes und ist in Vergleich zu analogen Baustoffen deutlich billiger wegen der Benutzung der Aschenabfälle. Den Baustoff gibt es als aufgeschäumtes und nicht aufgeschäumtes Material.

Aus unserer Untersuchung wird ersichtlich, dass die Füllung der polymeren Kunststoffe mit den Teilchen der Asche zwar zu einer Steigerung der Dichte führt, aber das Aufschäumen

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mit einem gasbildendem Stoff die Dichte um 1,2 – 1,5 Mal absenkt.

Die Füllung mit der Asche steigert die Sprödigkeit, da die Zug- und Biegefestigkeit der Proben sich etwas verringert (ca. um 1,7 bis 1, 9 im Vergleich zum ungefüllten polymeren Kunststoff). Die Sprödigkeit der nicht aufgeschäumten Proben liegt bei 35, 36 MPa.

Sprödigkeit hängt auch von dem Vorhandensein eines Weichmachers ab. Mit der Steigerung der Konzentration eines Weichmachers sinkt die Sprödigkeit von 32,83 MPa auf 32,10 MPa.

Die Zähigkeit der porösen Stoffe ist deutlich geringer als der nicht-porösen, dessen Zähigkeit bei 34,11 kJ/m^2 liegt. Das erklärt sich durch zellähnlichen Aufbau der Stoffe.

Die beste Wasseraufnahmefähigkeit der untersuchten Stoffe liegt bei 0,2%.

Während der Untersuchungen des Längenausdehnungskoeffizientes bei 100° C innerhalb von 60 Minuten zeigten die Proben der aufgeschäumten Stoffe nur eine minimale Längenänderung. Damit hat die Auffüllung des Polymers zu einer deutlichen Abnahme der Längenausdehnung geführt.

Die Härteprüfung nach Brinell zeigte, dass die Härte der Proben mit der Zunahme der Menge an Füllung ansteigt. Außerdem fanden wir heraus, dass nicht aufgeschäumte Stoffe eine höhere Härte als aufgeschäumte aufweisen. Die maximale Härte nach Brinell unter allen Proben lag bei 337 HW. Also beeinflusst sowohl die Menge an Füllmittel in dem polymeren Kunststoff als auch das Aufschäumen die Härte der Baustoffe.

Die Analyse unserer Ergebnisse zeigte, dass die Zugabe von Füllmittel (Asche) zum Polyvinylchlorid-Kompositen nicht nur dessen Preis reduziert, sondern auch die physikalischen und mechanischen Eigenschaften verbessert.

Die Materialen wurden vorbereitet mit der finanziellen Unterstützung des Bildungsund Wissenschaftsministeriums Russlands und des föderalen Förderungprojektes "Wissenschaftliche und Lehrende Mitarbeiter des innovativen Russlands" 2009-2013.

E.V. Zelinskaya N.A. Tolmacheva N.V. Fedotova	LEHRPROGRAMME SICHERHEIT``	ZUM	THEMA	"ÖKOLOGISCHE
E.A. Popova A.S. Shevtsov	Staatliche Technische Un	iversität 1	Trkutsk, Irkut	sk

Um die Ziele der innovativen Entwicklung Russlands zu erreichen, setzte der Präsident der Russischen Föderation die Schwerpunkte der Modernisierung der Volkswirtschaft fest, zu denen unter anderem die Steigerung der Energieeffizienz und die Ressourceneinsparung gehören.

Zur Lösung dieser Aufgaben sind hochqualifizierte Ingenieure erforderlich. Zur Ausbildung solcher Fachkräfte sind folgende Bedingungen zu erfüllen:

• AusarbeitungeinerListederWeiterbildungsangeboten für die Schwerpunktrichtungen der Modernisierung und technischer Entwicklung russischer Volkswirtschaft (Steigerung der Energieeffizienz und Ressourceneinsparung), die russische Hochschulen und

Weiterbildungszentren entsprechen den für die Schwerpunkte erforderlichen Kriterien anbieten

• Vermittlung und Organisation der Schulungen und Weiterbildungen mit praktischen Teil in führenden Forschungs- und Ingenierwissenschaftszentren in Russland und in Ausland

Weiterbildungsangebote der Staatlichen Technischen Universität Irkutsk gehören zu den Gewinner des Wettbewerbs zum Zwecke der Unterstützung und Förderung bester Schulungen und Weiterbildungen für Ingenieure in den Schwerpunktbereichen der Modernisierung und Entwicklung russischer Volkswirtschaft.

Der Weiterbildungsangebot "Neueste ressourcensparende Methoden der Gewährleistung der ökologischen Sicherheit von Wirtschaftsunternehmen des Sekundärsektors" ist zugeschnitten auf die Steigerung der Kompetenz der Fachkräfte durch das Kennenlernen praktisch realisierter Ansätzen für die Ressourceneinsparung und ökologischer Sicherheit.

Ziele der Weiterbildung:

• Vermittlung neuester Forschungsergebnisse in der Branche der ökologischen Sicherheit, Kompetenzsteigerung in diesem Fachbereich

• Darstellung der Beispiele der praktischen Lösungen zum Zwecke der Ressourceneinsparung und ökologischer Sicherheit, die in russischen Unternehmen eingeführt wurden

• Vermittlung der Arbeitsweise moderner analytischer Geräten

Ziele des Auslandpraktikums "Gewährleistung der ökologischen Sicherheit in den EU-Ländern" sind der Wissenszuwachs der Fachkräfte im Bereich der Ressourceneinsparung und ökologischer Sicherheit durch Kennen der internationaler praktischen Lösungen.

Aufgaben des Auslandspraktikums:

• praktische Vertiefung der theoretischen Kenntnisse der Fachkräfte im Bereich der ökologischer Sicherheit und Vermeidung der Schaden von potentiell ökologisch schädigender Wirtschaftsunternehmen, die im Weiterbildungsangebot erworben wurden

• Vermittlung der beispielhaften praktischer Lösungen zur Ressourceneinsparung und ökologischer Sicherheit in den EU-Ländern

• Teilnahme an der Entwicklung von Maßnahmen, aktuellen und zukünftigen Projekten und Plänen zur Ressourceneinsparung und ökologischer Sicherheit und Kontrolle deren Durchführung

• Vermittlung neuester internationaler Kenntnisse zur Ressourceneinsparung und ökologischer Sicherheit

Nach einem erfolgreichen Abschlusserhalten die Teilnehmer Teilnahmebescheinigungen über durchgeführte Weiterbildung nach üblichem Standard.

Die Arbeit wurde mit der Unterstützung des analytischen staatlichen Förderungsprogramm "Entwicklung des wissenschaftlichen Potentials der Hochschulen" 2009 – 2011 durchgeführt.

Adgur Ardzinba

# STAATLICHE WIRTSCHAFTSPOLITIK WÄHREND DER ÜBERGANGSPHASE

Staatliche Universität Abchasien, Suchumi

Man kann die Rolle des Staates in der Wirtschaftspolitik der Übergangszeit kaum überschätzen, denn gerade von der Wirksamkeit der staatlichen Politik während dieser Entwicklungsphase hängt der Erfolg der Reformen ab. Der Übergang von der verwaltungsgeplanter Wirtschaft zur Marktwirtschaft ist durch eine Reihe von ähnlichen Faktoren für jeden Staat bedingt. Dies sind vor allem eine überwiegende Mehrheit von nicht effektiv genutztem staatlichem Eigentum, zu den modernen Anforderungen und Marktwirtschaft nicht passende Gesetzesgrundlage und folglich eine starke Abnahme der Produktion der Waren, deutlich unterschiedliche Einkommensgruppen der Bevölkerung, starke soziale Schichtung, schlecht geregelte Eigentumsverhältnisse und so weiter. Der Zustand, in dem sich heutzutage viele Länder in der Übergangsphase befinden, zeigt, wie wenig wirksam die staatliche Regelung der Wirtschaft war und somit, dass dieser staatliche Eingriff komplett überdacht werden muss.

Wie der Wirtschaftsprofessor der MTI David M. Kots in seinem Vortrag "Die Rolle des Staates im wirtschaftlichen Umbau" zeigt, gibt es einen Konflikt zwischen den modernen in den Industrieländern dominierenden Ideen des Neoliberalismus einerseits und den historischen Erfahrungen im Bereich der Wirtschaftsentwicklung und der Wirtschaft in Übergangsphasen andererseits. Betrachtet man die wirtschaftliche Erfahrung der Säulen des Neoliberalismus – USA und Großbritannien – sieht man einen Gegensatz zwischen den historischen Erfahrungen und den modernen Paradigmen dieser Staaten. Man geht davon aus, dass Großbritannien den wirtschaftlichen Aufschwung des 18. – Beginn des 19. Jhd. durch die Laissez Faire Politik erreicht hat. Trotzdem, wie eine Reihe der geschichtlichen Fakten zeigt, konnte Großbritannien während der industriellen Revolution zur Zeiten der steigender Konkurrenz alle kontinentalen Staaten gerade durch eine aktive Einmischung des Staates sowohl im Inland als auch in der Handelspolitik überragen.

Im Grunde genommen haben diese Staaten die neoliberale Politik erst nach dem Erreichen der wirtschaftlich starken Lage zu ihrem erklärtem Ziel gemacht und propagierten diese als ein gewisses Instrument, um die eigene dominierende Lage in der Wirtschaft aufrechtzuerhalten.

Die Erfahrungen der späteren Industrialisierung sind noch beeindruckender. Japan, UdSSR und Südkorea konnten einen sehr schnellen Übergang von wirtschaftlich schwachen Ländern zu reichen modernen Staaten schaffen, und zwar durch aktive bis totalitäre staatliche Regulationseingriffe.

Allerdings gewährleistet eine starke Einmischung des Staates per se noch keine positive Entwicklung. Eine falsche wirtschaftliche Politik stellt aber ein unüberwindbares Hinderniss für das Progress dar. Während der Staat sich von den wirtschaftlichen

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Prozessen distanziert sind die Erwartungen, dass die unsichtbare Hand des Marktes selber die Grunvoraussetzungen zur Entwicklung schafft und der wirtschaftliche Progress sich selbstständig einstellt, völlig unrealistisch. Im besten Fall führt solche Politik zur Rückentwicklung, wie die Erfahrungen Russlands und vielen GUS-Ländern zeigt, im schlechtesten Fall kommt es zu einer wirtschaftlichen Krise wir in Russland 1998.

Also ist der Verzicht auf staatliche Regelung der Wirtschaftspolitik in der Übergangsphase potentiell viel gefährlicher, als eine nicht effektive Teilnahme des Staates an der Wirtschaftsregulation.

A.A. Ataeva J.S. Abubakarova

#### ECOLOGICAL ASSESSMENT OF DRINKING WATER QUALITY IN GROZNY, CHECHEN REPUBLIC

Chechen State University, Grozny Chechen State Petroleum Technical University named after the academician M.D. Millionshchikov, Grozny

Assessment of drinking water quality is the top priority among the issues addressed at the State level. Provisioning drinking water to the population of Grozny is particularly important and is associated with the change of natural properties of major water-supplying sources (Goytinsky, Sunzhensky and Chernorechensky) due to anthropogenic factors. The main sources of water pollution are connected with dumping household and industrial sewage, and storm water run-off contaminated to varying degrees. Comprehensive environmental research on major drinking water contaminants including heavy metals is relevant to date. Toxicological assessment of the impact of specific complexes of heavy metals on model objects belonging to various taxonomic groups of living organisms has high scientific and practical value.

The goal of this study was ecological assessment of the quality of drinking water from different water-supplying sources in Grozny before and after water treatment.

Experimental studies were performed at the Department of Human and Animal Physiology and Anatomy, Chechen State University, and at the laboratories of the Chechen State Petroleum Technical University named after the academician M.D. Millionshchikov. For our research, we used water samples from different sources of drinking water in Grozny (Goytinsky, Sunzhensky and Chernorechensky) before and after water treatment. As a control, we used distilled and artesian water. Comprehensive ecotoxicological studies were conducted following the guidelines of MU 2.1.5.720-98 and "The Guidelines for the Experimental Studies of Chemicals for Their Hygienic Regulation in the Water" (Moscow, 1985).

We used analytical laboratory methods along with ecotoxicological, physico-chemical, toxicological and biological research techniques. In analytical laboratory studies, we compared treatment and control samples for pH, total alkalinity, general hardness, total dissolved

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solids, total petroleum content, surfactants, phenols, and permanganate oxidability. Beforeand-after treatment isotopic content of water was determined by mass spectrometry using the inductively coupled plasma mass spectrometer with VG PQ ExCell data processing system. Range of measured concentrations amounted to eight orders of magnitude. Sensitivity of measurements amounted to  $n^{*}10^{3}$  till  $n^{*}10^{5}$  impulses per second for a chemical with the concentration of 1 µg/l (Karandashev et al. 2001).

Water toxicity was evaluated experimentally using bioassay technique on planktonic crustaceans (Daphnia magna Straus). Besides using mortality rates of parental generation of Daphnia following the guidelines of available ecological research methodology, we have also used additional criteria (such as fertility changes in surviving females, duration of incubation of the first litter prior to hatching from the brood pouch, the total number of hatched offspring, and feeding rates) for the assessment of toxicity of water samples. The criterion of acute water toxicity to Daphnia was the loss of  $\geq$ 50% of individuals in 96 hours.

Statistical treatment of experimental data was conducted using commonly accepted methodologies (Ashmarin et al. 1973). Results were calculated using computer software Statistica 6.0 for Windows (Stat Soft, Inc., USA) and Microsoft Excel 2003 (for Windows XP).

Our results showed that the top priority contaminants of drinking water in Grozny were petroleum, synthetic surfactants and heavy metals, which were detected in concentrations above the occupational exposure limits (OEL) in 14% of water samples. Mass spectrometry analyses of before-and-after treatment water samples for microelements showed that all water sources had fairly significant amounts of calcium and magnesium, and the ratio of these elements was very beneficial for drinking purposes. We have also detected the presence of sufficient amounts of nutrients (such as potassium, phosphorus, iron, copper, etc.) required by all multicellular aquatic living organisms for their essential metabolic enzymes.

We discovered high strontium content in all water samples, which was typical for such calcium-rich waters. It is well known that the presence of calcium in water neutralizes detrimental effects of strontium on living organisms. Presence of aluminum, silicon, phosphorus, and a number of elements from titanium to selenium in these waters was found at the levels below OEL. Only trace amounts of dangerous beryllium and cadmium were found, which characterizes these waters on the positive side.

Chernorechnsky water source had considerably lower levels of potassium content than other water sources whereas its silver content was  $0.32 \mu g/l$ . Other surveyed waters had almost no silver. At the same time, lithium, zinc and nickel were found in concentrations greater than other heavy metals that did not go beyond OEL. Other disadvantages of all studied water sources were small concentrations of iodine and manganese, which were below average standard values. Mercury and uranium in waters used for fish cultivation were not found to exceed OEL.

Our results led to the conclusion that all conventional characteristics of water quality and its chemical composition in all sources supplying drinking water to Grozny comply with current State Regulatory Standards. Therefore these waters are fully suitable for drinking usage. However, further research on microelement content of water sources revealed the specific features of each source in terms of the compositions of isotopes of the chemical elements that define the specificity and quality of drinking water. Presence of heavy metals such as lithium, zinc and nickel, combined with halogens widely represented in local water sources, contributes to the formation of specific salt complexes. These complexes are not eliminated in the course of water treatment. Their detrimental effects on vital systems and organs of humans and animals may be strengthened by chlorides diluted in water.

We evaluated ecological toxicity of heavy metal salt complexes in the drinking water of Grozny. Our experiments revealed the inhibiting effects of nickel, zinc and lithium salts on the viability, fecundity and feeding rates of Daphnia. We quantified changes in physiological activity of laboratory animals caused by the changes in concentrations of heavy metal salts in drinking water supplies of Grozny before and after water treatment. We also investigated long-term consequences of the biological effects of heavy metal salts.

In the course of present study, we improved methodology of the ecotoxicological assessment of water quality. We also pioneered in computing environmental risks and health damage risks to the population of Grozny from drinking water containing a specific complex of heavy metal salts.

We conclude that our studies confirmed that the conventional combined water treatment technique does not ensure an effective removal of the salts of heavy metals from water supplied from various sources to the city of Grozny.

V.S. Chekalin

### THE MUNICIPAL HOUSING AND COMMUNAL SERVICE IN THE CONDITION OF REFORMS

SPb State University for Engineering and Economics, Saint Petersburg

There are a lot of problems in the housing and communal services in the most Russian cities: high deterioration of multistoried apartment buildings and community facilities, a considerable accident rate of residential and community facilities, poor quality of housing and communal services, the constant growth of the rates, the great loss of communal resources during transportation and consumption.

The reasons for the increase of problems in housing are both objective - underfunded and, as a consequence, the backwardness of the material and technical base, and subjective - the fragmentation of ownership in the multistoried apartment buildings, lack of professionalism in the management, administrative and institutional dominance of the mechanism of management.

That is why the most important task at present time is to reform the system of housing. The main directions of the housing and communal reform are improvement the effectiveness of management, formation of a competitive environment, promotion of saving energy and

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resources, balancing the price and quality of housing and communal services, targeted social support of the population in the process of reforming.

In accepted legal documents we can see a history of housing reform:

• 1997 - The concept of municipal housing and communal reform (President's decree)

• 2001 - Sub-program "Modernization and reform of housing and communal services of Russia" (Government's decree)

• 2005 - The Housing Code (Federal Law)

• 2007, "The Fund for Housing Reform" (Federal law)

• 2010 - The concept of program:"A complex program of modernization and reforming of housing for 2010-2020" (government order)

• 2011 - The new version of the Housing Code (Federal Law)

The implementation of housing reform is too slowly. There are many problems involved in its realization: contracts for services in this sphere are missing or formal, control in the housing sector is clearly insufficient, owners of the apartments are passive, competition is not enough, lack of information on the status of multistoried apartment buildings, resource programs are not effective, there is no relationship between level of payments and the quality of services, repairs are emergency in nature, existing maintenance program of multistoried apartment buildings does not contain performance criteria and application.

Therefore there it is necessary to adopt a set of measures to intensify the reform of this sector, among which the most important are the following:

- Adoption of an effective resource program
- Introduction of direct contracts with suppliers of communal resources
- The gradual transition from emergency recovery to preventive overhaul

• Ensure that the relationship between the level of payment and the quality of municipal services based on quality standards.

• Effective control over the fulfillment of contractual obligations

The main condition for the effectiveness of housing reform is the transition to professional management and owners participation in the ongoing reform.

M.A. Lyubarskaya

# VERIFICATION OF WASTE OILS LOGISTIC CHAIN IN THE NORTH-WEST RUSSIA ON THE BASIS OF THE ANALYSIS OF INTERNATIONAL EXPERIENCE

Saint-Petersburg State University of Engineering and Economics

The ENPI program (European Neighborhood Partnership Instruments) provided development and implementation of projects in the territory of the North-West Russia and the South-East Finland, which are devoted to solving of the common problems within three priorities: Economic Development, Common Challenges, Social Development and Civil Society. Within the second priority in 2012-2013 according to the Contract No. 2011-

028-SE558 for the Provision of the Grant by the European Community implementation of the project «Clean Oil (CO) – Improvement of waste oil management in North-West Russia and South-East Finland» is carrying out. The leading partner of the project is JSC «Ekotrans», partners of the project are Saint-Petersburg State University of Engineering and Economics, Lappeenranta University of Technology and L&T Recoil Oy.

During implementation of the first stage of the project the following problems of an existing waste oils logistic chain in North-west Russia were revealed. First, collecting of different types of waste oils is conducted in the general container that considerably reduces possibilities of their subsequent processing and useful involving in economic circulation. Secondly, waste oils generators have no information on the correct methods of collecting and utilization of waste oils. Thirdly, waste oils processing in St. Petersburg and Leningrad region is conducted at several small enterprises that is obviously not enough for such large region. Therefore the main way of waste oils handling today is their dumping in the surround environment or burning in heating installations and coppers, mainly without preliminary cleaning that leads to formation of a large number of harmful emissions to environment.

At the same time, in world practice there are the technologies, allowing to get useful products from waste oils. One of such examples is the technology applied by the company L&T Recoil Oy. Company slogan is «Giving oil a new life». The products of waste oils processing are base oils (70%), fuel (15%), bitumen (10%), water (5%).

Being the partner of the project, the L&T Recoil Oy company to prevent negative impact on ecology of St. Petersburg and Leningrad region, is ready to accept waste oils from this region for processing. Functions of collecting and export of waste oils at this stage were assumed by the leading partner of the project JSC «Ekotrans».

Further all partners of the project will take part in development and verification of optimum waste oils logistic chain for St. Petersburg and Leningrad region. Certainly, in St. Petersburg it is necessary to organize the enterprise for waste oils processing. An important question is the choice of technologies of processing. There are the foreign and domestic technologies, allowing to receive various useful products from waste oils. On a choice of technologies of processing important influence renders quality of collected waste oils and possibility of their cleaning.

There are a number of factors to which it is necessary to pay attention at creation of optimum waste oils logistic chain for St. Petersburg and Leningrad region at a collecting stage.

The firs important factor is organization of separate collection of waste oils representing a waste, relating to various groups: synthetic and mineral waste oils, synthetic and mineral oils which have lost consumer properties, waste of emulsions and emulsion mixes for the machining, containing oils or oil products, combustive-lubricating materials, lubricant cooling liquids, etc. Waste oils are subject to separate collection and waste oils generators shouldn't mix them up with a consumption and production waste. At separate collection of waste oils mixing of different types of the waste oils is forbidden.

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The second important factor is increasing of culture of accumulation and storage of waste oils. On the majority of the enterprises providing of information and special trainings for increase of culture of accumulation of waste oils is required. The most correct accumulation and storage is the allocated vertical tank of cone mould, with the bottom drain crane, an outlet, a lightning rod, grounding, with strict system of access, with tight overlapping from a natural precipitation and errors of a human factor.

The allocated tank prevents mixture of various oils. Vertical execution helps fast stratification on oil and condensate. The bottom crane condensate plum from the tank simplifies system periodic. The strict system of access will provide control over safety of amount and quality of waste oils. Tight overlapping prevent hit in oil of the stranger: a rain, snow, garbage, the stubs, waste oils of other groups, antifreeze, water, rags, sticks, etc.

At the stage of waste oils processing at creation of optimum waste oils logistic chain for St. Petersburg and Leningrad region attention should be paid at following factors:

1) economical and technical possibility of the organization of processing on the chosen technology on a concrete platform at territory of St. Petersburg and Leningrad region;

2) ecological safety of the chosen technology, including minimization of negative impact on environment, reduction of volume of a being formed waste etc.;

3) existence of necessary waste flow for the organization of processing of waste oils on the chosen technology, including qualitative, quantitative characteristics of waste oils, possibility of its delivery with the established periodicity etc.;

4) demand of products of waste oils processing by consumers, including preliminary definition of the list of consumers, the conclusion of contracts on acquisition of products of processing etc.;

5) social effect from introduction of the chosen technology, including creation of new workplaces and providing safe working conditions at the enterprise.

Only the accounting of potential local characteristics of activity according to the list of criteria provided above and the analysis of foreign experience will allow to develop of optimum waste oils logistic chain for St. Petersburg and Leningrad region.

A.L. Elderhanova A.A. Ataeva E.I. Tikhomirova

### ASSESSMENT OF BIOLOGICAL ACTIVITY OF SOILS IN DIFFERENT REGIONS OF CHECHEN REPUBLIC

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It is well known that ecological condition of soils depends on three groups of factors: pollution parameters, soil properties, and environmental variables. The first factor group includes chemical structure of pollutants, their concentrations in soil, time that passed

from the moment of initial contamination by a pollutant, etc. (Kolesnikov, 2004). The second group of factors is comprised of soil structure, particle size distribution, humidity, content of humic substances, microbiological activity, and rates of biochemical processes in soils. The environmental variable group encompasses temperature, wind speed, solar radiation levels, proportion of ultra-violet radiation in solar radiation, vegetation cover, etc. Therefore, while planning and conducting comprehensive assessment of soil status, it is necessary to ensure that all relevant environmental variables and factors are measured simultaneously.

The integrated index of soil biological condition (IISBC) was proposed for environmental assessment of soils (Kolesnikov et al., 2002). Its computation requires collection of data on soil biological activity, soil toxicity, soil enzymatic activities, and microbial flora in soils. Knowledge of species composition and densities of microbial flora is of particular importance because microbial flora and microfauna require specific environmental conditions to provide soil ability to cleanse itself from contamination.

We studied various types of soils in Chechen Republic. With this goal in mind, we conducted microbiological, toxicological and chemical analyses of soil samples.

We identified qualitative and quantitative composition of microbial communities in soils by planting soil solutions on various diagnostic nutritive media. We then counted colony forming units (CFU), and studied morphology of microbial cells and colonies. Toxicity of soil samples was assessed by employing bioassay test methods using crustacean Daphnia and alga Chlorella as bioassay objects.

We also conducted ionometric and potentiometric analyses of soil samples for heavy metals, determined soil respiration rates using conventional methods, and assessed potential biological activity of soils. The latter was measured in vitro by creating optimal conditions for natural soil processes.

Thus, our comprehensive study of various soil types was the first of the kind conducted in Chechen Republic. Our results revealed the presence of heavy metals in soils within maximum permissible concentrations (MPC). The results of toxicity assessment of soil samples matched with the data on heavy metal concentrations accumulated by bioassay test-objects Chlorella vulgaris Beyerinck and Daphnia magna Straus.

Simultaneously with bioassay studies, we estimated soil respiration rates as an integral index of soil biological activity. We discovered significant reduction of soil respiration in the soil samples from areas with anthropogenic impact.

As for results on microbial composition of soil samples, they showed numeric changes in microbial content of various taxonomic groups. In soils affected by anthropogenic impact, we observed slight decrease in total microorganism abundance and also fluctuations of microbial densities affecting the rates of microbiological processes in those soils.

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G.N. Falkova I.S. Trapeznikova

# ECONOMIC AND ORGANIZATIONAL MECHANISMS OF THE CONCEPTUAL APPROACH TO WASTE TREATMENT

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Management Econimics, Kemerovo State University, Kemerovo

Today improvement of the waste management system is recognized to be the main environmental task in the Russian Federation. The main steps towards the solution of this problem were determined during the World Summit on Sustainable Development in Johannesburg in September 2002. The key moments of the conference, among other things, include "waste prevention and minimization, reuse and recycling as well as the use of environmentally friendly alternative materials, with the participation of government authorities and all stakeholders, in order to minimize adverse effects on the environment and improve resource efficiency".

Environmental pollution caused waste from production and consumption has been becoming an increasingly large problem, the acuteness of which is understood not only by professional environmental scientists. Waste is one of major factors of anthropogenic influence on the environment which cause the deterioration of living conditions for people. The present experience shows that only 20-40 % of the extracted and recycled resources are used in full, whereas the largest part, the hidden part of the iceberg, is turned into waste of different degree of danger. As a result, the major part of the extracted natural resources turns to waste, which often is of a much larger environmental danger than the primary resources, and therefore is a direct or indirect source of pollution.

The questions of use of waste from production and consumption have actually fallen out of the area of centralized state administration. The current situation is aggravated by the absence of efficient regulatory and legislative, institutional and organizational conditions in the area of waste treatment as well as material and technical base of efficient recycling. In order to preserve the quality of environment and to minimize waste disposal, the Kemerovo region has developed a concept in the area of waste treatment, the fundamental positions of which are directed towards the most optimal way of technological development. It means either the introduction of low-waste production or a change in the waste structure –it becomes less harmful and, therefore, more suitable for recycling into household products.

Waste involvement into economic circulation represents a multi-aspect problem, dealing with all areas of material production, and an economic-organizational mechanism of realization of the conceptual approach to waste treatment contributes to the creation of economic instruments favourable for someone who owns waste. These instruments make it possible to transfer the financial burden to waste producers to such an extent that costs stimulate a decrease in the waste volume. Another way of solving these issues is to offer a business entity financial incentives in the form of preferential credits, tax concessions or grants if they implement projects to reduce waste formation and disposal volumes which have a significant influence on the sanitary state of territory.

An instrument is referred to as "economic" if it touches upon costs estimates and advantages from alternative actions made by organizations that directly deal with waste treatment, and also influences their conduct and decision making in such a way that in the end they chose alternatives which create a more favourable environmental situation in the urban area.

Economic instruments, in contrast to regulatory ones, leave members of waste treatment process a freedom of choice in the use of certain stimuli which benefit them most. These instruments are:

1. Preferential tax treatment, tax differentiation, preferential crediting, grants which represent forms of financial aid that do not need to be paid back.

2. Collection of a monetary deposit on certain kinds of goods, including containers and packaging. The efficiency of this system consists in the resource preservation and reduction of solid waste. Even if end consumers dispose of products with a monetary deposit on them, this type of waste has a market value and can be taken out from the waste flow by other people during waste collection. In the Russian Federation, this function is normally performed by the homeless, for which receiving money for giving back containers is one of the sources of subsistence.

3. Creation of secondary materials markets and products of their recycling. This is one of the main instruments to increase the efficiency of operating benefits in companies which deal with waste reuse and recycling and use secondary materials in their production processes. Cooperation between suppliers and consumers of secondary materials creates certain, economically sound prices on the market. A drive to receive additional income makes suppliers improve the quality of the materials, performing a more thorough separation of waste to be recycled. Firstly, it leads to the increase in the profitability of the waste treatment field, secondly, to the improvement of consumer characteristics of the end product.

M.M. Fiskina E.M. Fiskin E.V. Zelinskaya I.V. Miserev

### ZUR ÖKOLOGISCHEN AUSBILDUNG DER STUDENTEN AN DER TECHNISCHEN UNIVERSITÄT

: Staatliche technische Universität Irkutsk, Irkutsk

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Der Hauptgrund für die ökologische Krise und die bestehenden Unterschiede in der Interaktion der technischen Ausrüstung und der natürlichen Umwelt ist das niedrige Niveau des Umweltbewusstseins der modernen Gesellschaft. Schwerpunkte der Arbeit imBereich der ökologischen Modernisierung der russischen Wirtschaft, die unser Präsident identifizierte, sollten natürlich mit der Umwelterziehung verbunden werden.

Eine der Bedingungen für die Verringerung der anthropogenen Auswirkungen auf die Biosphäre ist die Ökologisierung der technischen Ausbildung. Unter modernen Bedingungen sind neue Konzepte und Techniken für den Prozess nötig. Ingenieurausbildung musste den zukünftigen Fachmann für Aktivitäten richten, die mit dem Projektieren und dem technischen Objekt verbunden sind und die auf der ökologischen Sicherheit basiert.

Die Wirksamkeit der Umweltausbildung hängt von der regionalen Komponente ihrer Inhalte und der Besonderheiten der künftigen Fachrichtung von Studenten ab. Diesem Problem wird aber keine genügende Aufmerksamkeit geschenkt.

Das Thema des Forschungsvorhabens ist der Inhalt und die Bedingungen der Umweltausbildung von Studierendeneiner Fachhochschule am Beispiel der Gruppe von Fachrichtungen 210 000 "Electronic Engineering, Funktechnik und Kommunikation." Die Grundlage der Umweltausbildung schließt in sich Prinzipien des komplexen oder multidisziplinären Ansatzes, soweit ökologische Aspekte der Stoffproduktion, Komponentenbasis der Radioelektronik, die Verwendung von radioelektronischen Systemen (elektromagnetischer Einfluss) und die Fragen der Verwertung von Erzeugnissen bedeutend werden. Es ist auch wichtig kognitiver und aktiver Lernansatz in der Ausbildung, wenn das theoretische Wissen (zum Beispiel in der Disziplin "Ökologie des elektronischen Zahlungsverkehrs") die Anwendung bei der Vorbereitung von Klausuren und Abschluss-Qualifikationsarbeiten den Einsatzfinden.

Von besonderer Bedeutung für die Umweltausbildung ist das Absolvieren des Bekanntschaft- und Betriebspraktikums. In diesem Zusammenhang sollte das Programm der Praktika die Fragenüber den Einfluss der Betriebstätigkeit auf die Umwelteinschließen. Dazu müsste man im Programm solche Praktika in Betracht nehmen wie visuelle Beobachtungen, Labormessungen und ökologischer Monitoring.

Die Analyse der Lehrpläne von verschiedenen Fachrichtungen zeigte, dass Elemente der angewandten technosphärischen Öko-Sicherheit in verschiedene Fächer eingeführt werden könnten und als Grundlage für ökologische Komponente des Systems der technischen Ausbildung dienen. Zum Beispiel: ins Programm des Kurses "Grundlagen der Mikroelektronik", wo in einem Abschnitt die wichtigsten Produktionsprozesse von integrierten Schaltungen betrachtet werden, ist es möglich, einen Abschnittüber die Umweltfragen der Produktion sowie Nutzung von mikroelektronischen Produkten einzuschließen.

Als erste Etappe in der Durchführung von Forschungen auf dem Gebiet der Öko-Ausbildung einer technischen Universität ist das Feststellen der Öko-Kultur der Studenten. Mit diesem Ziel wurden entsprechende Fragenbodenerarbeitet, deren Fragen mit der ökologischen Richtung der zukünftigen Berufstätigkeit der Absolventen in der Fachrichtung "Elektronentechnik, Funktechnik und Kommunikation" verbunden sind.

Zum Schluss sollte gesagt werden, dass die Öko-Ausbildung im modernen Dual-System einen wichtigen Platz findet.

#### S.V.Kholodkevich BIOELECTRONIC SYSTEMS AND TECHNOLOGIES FOR SURFACE AND TREATED SEWAGE WATERS QUALITY CONTROL ON THE BASE OF MEASURING PHYSIOLOGICAL AND BEHAVIORAL BIOMARKERS IN MACROBENTHIC INVERTEBRATES

Institution of Russian Academy of Sciences St. Petersburg Scientific Research Center of Ecological Safety RAS, St. Petersburg

In the 1990s an original fiber-optic non-invasive method for cardiac activity monitoring in the invertebrates with exoskeleton (crustacean, bivalvian and gastropod mollusks) was developed in the laboratory leaded by S.V.Kholodkevich. In 2005 on the base of it a System for Industrial Biological Water Quality Monitoring (SIBWQM) was created. Since 2006 similar SIBWQM are operated at all 11 water intake facilities of water treatment plants of St.Petersburg as biological early warning (within ten minutes) systems reporting about dangerous level of influent water toxicity in case of emergencies and/or terrorist acts in the water intake zone of the centralized water supply system, to ensure chemical and ecological safety of portable water supply to the population.

The biomarkers measured by SIBWQM, their values and variations being analyzed to assess the raw water quality in real time, are given below.

**BIOMARKERS:** 

- $\Delta$ HR heart rate change (%)
- dHR/dt derivative of HR
- SI=1/2(CI<sub>m</sub>\*SD<sup>2</sup>) stress-index
- Time and duration of repeatability of the test organism circadian rhythm, in %.

The same biomarkers are used in the systems SIBWQM, which was installed at the South-West Wastewater Treatment Plant (SWWTP), Wastewater Disposal Branch of SUE "Vodokanal of St.Petersburg". The main purpose of developing such a system is a realtime monitoring of toxicological safety for hydrobionts of biologically treated effluent, discharged by SWWTP in the Neva Bay. If the quality of water where the animals live deteriorates sensitive crayfish would feel that at once, while the automated biomonitoring system created by the St. Petersburg Scientific Research Centre of Environmental Safety at the Russian Academy of Science (SRCES RAS) will not only indicates the changes in their behaviour but also generate an alarm signal which will reach the South-West WWTP's control room via the computer network. The sensor transmits parameters of the animal's cardiac activity in real time. If suddenly the heart rate of all six crayfishs grows 1.5-2, the red signal of the "traffic light" system in the control room would start to flash. Process engineers at the treatment plant would work to identify and eliminate the reasons of the incident.

The aim of this report is to highlight the main principles and approaches of using

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bioelectronic systems for elaboration of new methods and technologies of active and passive bioindication of ecosystem status at different anthropogenic impacts. Author's experience in manufacturing a number of operating bioelectronic systems for real-time monitoring. Particularly, the monitoring of :

1) toxicity of surface water (mollusks, crabs and crayfish as test-organisms);

M.A.

2) toxicity of biologically treated municipal waste water discharged into area of fishery water bodies (crayfish);

M.A. Lyubarskaya N.S. Klunko	INNOVATIVE APPROACH TO INTRODUCTION OF CONTROLLING SYSTEM AT THE ENTERPRISES OF THE RUSSIAN PHARMACEUTICAL COMPLEX
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The pharmaceutical enterprises play important role in ensuring the vital requirements of the population in medicines. A necessary condition of their functioning in modern conditions is using of effective instruments of management at all stages of production. Controlling, being the concept of system management, is organized at such enterprises, where management is in crisis or economic activity doesn't meet modern requirements of the market. The following factors point to need of creation of controlling system at the enterprises of the Russian pharmaceutical complex: deterioration of economic indicators; emergence of the new purposes in the conditions of the developed functioning; lack of the agreed target of development of the enterprise; out-of-date methods of planning, accounting and analysis; lack of techniques of the account and the analysis, discrepancy to requirements as a basis for tracking of activity and adoption of administrative decisions; duplication or absence of some functions, existence of conflict situations at their performance.

Process of introduction begins with making decision on development of the controlling system at the enterprise. Turning point to start creation of controlling system is emergence of the first signals or forecasts about possible risks and threats for success of functioning of the enterprise. It is a question both of internal and external events for the enterprise and factors which are shown ordinary or in hardly noticeable tendencies, or instantly with change of external factors (legislation, market conditions, etc.). After making decision on development of the controlling system and appointment of responsible persons the stage of formation of tool base of controlling begins.

All instruments of controlling which are developed for the concrete enterprise, should

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be effective and clear to users. An indispensable condition is productivity of the tool. The employees who are carrying out functions of controlling should be able to present own production in the enterprise to specific users as other use of the tools developed by them in the current activity of managers becomes practically impossible. The employees who are carrying out functions of controlling should show effectiveness of the developed tools and to convince managers of need of their introduction in practical activities.

As practice shows, introduction of the controlling system at the enterprises is accompanied by numerous problems. Scientists allocate the main groups of factors interfering the successful organization of controlling at the enterprise (table 1).

Group of factors Group characteristic Are caused by approaches created throughout much years of Historical business, not always sufficient economic knowledge of managers Are connected with skeptical views of the management on the Psychological controlling introduction which results are visible not at once, and introduction rather expensive and long. Are caused by absence of experience of formation of desirable results from controlling introduction, complexity of involvement of Organizational skilled workers in this process Arise owing to ignoring of necessary restructuring of business, unsuccessful allocation at the enterprise of the centers of responsibility, Methodical a choice of inadequate principles of transfer pricing, ignoring of need of creation of a package of corporate standards of controlling

Table 1. The main groups of factors interfering the successful organization of controlling at the enterprises of the Russian pharmaceutical complex

S.S. Rabava

#### STIMULATION OF ECOLOGICAL BUILDING

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The concept «green building» means building of power effective ecologically steady buildings with the maximum use of renewed power resources and high level of comfort for the person. Green Building assumes economical use of resources in the organizations of the water supply, heating, illumination, an electrical supply, and also rational use of building and finishing materials, technologies of the recuperation, alternative energy sources and so forth.

The Criteria of buildings of category Green Building are determined by the ecological standards. A version of a green building is "the power effective" house. The

power concept of the power effective house is directed on power consumption decrease in new buildings at 8-10 times.

For Belarus the power savings problem is actual, many legal documents regulating this question are accepted. In particular in the country ecological certification of goods and services is legislatively fixed. However, its action does not extend on ecological building. Further enhancement of normative and technical adjustment of the power market, including in such direction as power efficiency of buildings is planned.

Since 2009 in Belarus the Complex program on designing, building and reconstruction of power effective apartment houses in Belarus for 2009-2010 and on prospect till 2020 is accepted. During its realization for 2009-2011 it has been constructed and placed in operation 810,3 thousand M2 power effective apartment houses. However, the given program does not concern buildings industrial and a commercial real estate. The raised costs at building of green buildings, absence of a legal regulation, administrative and economic measures of stimulation do building of those buildings not popular.

Today neither citizens, nor builders, and investors are interested in building of green buildings. At the given stage the most reasonable is stimulations of ecological building at the state level.

Regarding technical and legal regulations is a development and entering of ecological standards with reference to our climatic zone and to national standards of building; entering of ecological certification of buildings. It will allow to reveal a building constructed on ecological standards and to apply to them measures of provision of economic incentives. So, privileges under the taxation can be used; budgetary financing of ecological building or a difference between cost of a traditional and green building; tax preferential rates at financing of green buildings; "the green" tax providing restriction of emissions and environmental contamination.

As an economic method to attract investments in ecological building a "green" tax can be introduced. As a rule, it enters in the form of the fine on the company, excessively using power resources. "The green" tax represents itself as stimulus for reducing of emissions in environment and predetermines ecological stability, connecting profit directly with power consumptions. Besides it, effective there can be a privilege decrease under the profit tax at building of green buildings and use of alternative kinds of energy

Besides administrative and economic measures of stimulation of green building application of psychological methods of influence is necessary. In particular, social advertising of green projects, educational programs at educational institutions. Carrying out of competitions on the best ecological project and public rewarding of the businessmen participating in given projects. Constant discussion in mass-media of questions of ecological building and forming of positive image to investors and the builders who are engaged in ecological building in Belarus.

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Dirk Schöps

# RECYCLING OF ELECTRONIC SCRAP – A CONTRIBUTION TO A SUSTAINABLE ECONOMY

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Electronic scrap mainly consists of ferrous metals, non ferrous metals, plastics, glass and circuit boards. The circuit boards contain almost all the elements of the periodic table except the noble gases and the radioactive elements. 80 - 90 % of the material can be utilized. The price rally of raw materials pushes the recycling activities.

The waste stream of electronic scrap is increasing worldwide. In Germany and other west European countries each consumer produces 20 kg of electronic scrap (WEEE) per year. 8 % of this amount is illegally exported. In some other industrialized countries this rate is much higher. Rich countries buy electronic appliances and poor countries recycle them.

Asbestos and polychlorinated biphenyls occur only in very old appliances, because their application is forbidden since one human generation. But mercury, cadmium, lead and some halogenated flame retardants are still widely present in the real existing electronic scrap. Unsuitable treatment causes a lot of harm, especially in developing countries.

The sustainable recycling of electronic scrap has economic, ecologic and social aspects.

Economic aspects:

The gold price today is three times higher than 5 years ago. The prices of other metals and crude oil increased in the same range within the last 10 years. The yield of valuable raw materials from electronic scrap correlates with the prices of raw materials.

Ecologic aspects:

CO2 emissions grow worldwide and cause the global warming of the atmosphere. A dramatic rising of the sea level is expected, when the glaciers and the ice caps of the earth poles are melting down.

The recycling of Gold saves 40-50 % energy consumption and CO2-emissions and the recycling of Aluminium saves even 95 % energy consumption and CO2-emissions compared to the production from natural sources.

Social aspects:

The recycling of electronic scrap offers jobs for semiskilled workers. Repaired appliances are cheaper than new ones – good for people with a small income. Recycling in the industrialized countries avoids the unsuitable treatment in developing countries. Violent conflicts on natural sources can be reduced by the recovery of raw materials from end-of-life goods.

ELPRO Elektronik-Produkt Recycling GmbH has set up a list of sustainability indicators. It contains the quota of labour costs, the value added per employee, the specific demands of energy, electricity and water, the specific CO2-emissions and others.

G.A. Trakhtengerts

# MAIN FACTORS, DETERMINING THE SIZES OF SANITARY PROTECTION ZONES FOR TAILINGS STORAGES

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Ore-dressing industry wastes, such as slurries, mill tailings etc. pose a serious hazard to environment components and human health, since such waste products normally contain salts of heavy metals (HM), flotation agents, oil products and other chemical compounds. As a result of thickening the slurries and tailings may contain elevated concentrations of natural radionuclides. In most cases the accumulation and storage places for such wastes, namely slurry and tailings storage facilities are technically imperfect. The slurry and tailings storage facilities, operating in Krivorozhsky iron ore basin, are not equipped with the bed impervious screens, for which reason the underground and subsurface waters are vulnerable to chemical contamination. Tailings storage facilities occupy areas of considerable size. Destruction of embankments and retaining dams is especially dangerous. The area affected by these objects is characterized by long-term penetration of toxic elements into the soil caused by wind erosion of tailings, washing-off into the surface waters with precipitations, infiltration into the subsurface waters and translocation in plants. The main source of technogenic hazards for adjacent areas is the accumulation of contained in atmospheric dust heavy metals in the soil. The dust is intensively generated during the process of oredressing and processing enterprises production activities. Analysis of heavy metals amount in solid wastes generated by Krivoi Rog and Komsomolsk ore-dressing and processing enterprises reveals surplus content of cobalt clarkes within the range from 1,1 to 6,4 times; nickel clarkes - from 1,4 to 4,8 times and zinc clarkes - from 4,5 to 10 times. Cadmium clarkes content may also be surpassed from 1,3 to 2,0 times. Heavy metals salts content and high mineralization of water in iron ore mill tailings result in high concentration of sulphates, chlorides and other compounds. Subsurface waters, located within the area affected by "Pervaya Karta" tailings storage, can be classified as sulphate-chloride magnesium-sodium type. In some cases, operation of tailings storages leads to change in chemical composition of subsurface waters, with rise of water salinity level up to 24 g/dm3 and total hardness up to 90-95 mg-eq/dm3. Manganese, plumbum, ferrum and other heavy metals are detected in subsurface and ground waters in amounts, which have not observed there before. Operation of an ore-dressing and processing enterprise produces changes in hydrogeological situation, thus leading to underflooding and swamping of adjacent grounds. Therefore the range of influence of tailings storages onto the hydrogeological regime and hydrosphere objects can spread beyond the line, that limits the maximum permissible concentration (MPC) of contaminating agents in the ambient air. In this regard, the water may be a crucial factor in determining of sanitarily-proved size of sanitary protection zones. However the main environment, which accumulates air pollutants and first of all the contaminated with heavy metals dust, is a soil. Therefore such factor is of high

importance in the process of sanitary protection zones' size determination. Contamination of soil in the areas, affected by ore-dressing and processing enterprises' tailings storages, can also be of hydro- technogenic origin, by means of contaminated drainage waters flows. Accumulation of pollutants in the soil as a result of sedimentation and removal by ground water flows takes place over a period of many years. That is why special zones are created on the adjacent to the tailings storages territories, for which the content of specific anthropogenic contaminants in the soil considerably exceeds the regional clarke indexes, and even sometimes the soil maximum permissible concentrations. The soil, which has accumulated heavy metals within the area affected by tailings storage, in case of dust rising becomes a source of secondary pollution of neighbouring environments, such as ambient air, underground waters and hydrographic network objects. That is why in proximity of settlements and agricultural lands the determination of surface soil contamination range dimensions is of high significance. In accordance with the applicable "State sanitary rules for planning and building of settlements" (SSR No. 173-96) for tailings storages, the same as for mining industry dumps (par. 8.33), the sanitary protection zone dimensions have to be determined by computational method, provided the finite size not less than 300m. Taking into consideration the tailings storages dusting zones, caused by the contaminated soil, in determining of sanitary protection zones dimensions it is necessary to calculate dust dispersion figures, to determine concentration levels of the main heavy metals (HM) (Fe, Pb, Mn, Zn, Cd) and make allowance for HM-contaminated soil zones, which itself are disordered sources of their emission into the ambient air.

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# ROLE OF STATIONARY LABORATORIES IN SYSTEM OF ENVIRONMENTAL MONITORING OF OBJECTS OF SURROUNDING ENVIRONMENT

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The rapid development of industry and the increase in the number of vehicles in major cities will inevitably lead to the pollution of air, water, soil, and, consequently, to a deterioration of the living conditions of the population. In this regard, the importance of increasing annually analytical laboratories (centers) of the main activity of which is the control and regulation of the amount of pollutants entering into the objects of the environment with the use of modern physic-chemical (instrumental) methods for the quantitative analysis.

In the report the main physical and chemical methods of the quantitative chemical analysis are considered. These are spectral and optical, chromatographic, electrochemical methods, mass-spectrometry, methods of an electronic paramagnetic resonance and a nuclear magnetic resonance, etc.

An important role in getting information on pollution also play a mobile controls that provide environmental information in real-time, virtually anywhere in the city. The report of the characteristic of currently shipping mobile laboratory to evaluate their possible with the instrumentation equipment, including tools and equipment for sampling rapid analysis of pollution of urban environment.

The considerable attention is given to mobile laboratory «Kema» of control of industrial emissions, now in use by Experts GPBU «Mosekomonitoring». By means of it for the first time in Russia experimental data on emissions of the gaseous pollution, the weighed substances (a dust, flying ashes, a sooty aerosol), heavy metals, PAU, dioxins in departing smoke gases of the large industrial enterprises (combined heat and power plant, incineration and steel works, etc.), located in various districts of the city of Moscow were obtained. These data allowed estimating level and scales of pollution of a ground layer of the atmosphere at considerable distances from the above-stated sources of emissions – in the territory of the next inhabited massifs, recreation areas, etc.

In the report ways of further development of hardware and methodical base of the Analytical centers as in respect of expansion of possibilities of definition of more wide range of pollution, and for the purpose of control of physicotechnical parameters and characteristics of technogenic sources of an urban environment (noise, radiation, electromagnetic radiations, etc.) also are discussed.

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### ABOUT ELEVATED SOIL CHROMIUM CONTENT IN NORTHERN CITIES OF RUSSIA

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As a part of complex ecological investigations, a soil surveying was conducted by Institute of Industrial Ecology of Ural Branch of Russian Academy of Sciences in Tarko-Sale town (Yamal-Nenets Autonomous District, Russia) in 2007.

Tarko-Sale was founded in 1932, acquired the status of an industrial community in 1976, and town status in 2004. It is located on a at plain, where an altitude difference is less than 20 m. The local soils are sandy alluvial-humus podzols with a little content of organic matter and with size fraction not more than 1 mm.

Soil samples were collected on a square grid with a spatial resolution of 250 m in the territory of residential and industrial zones. A total amount of samples was 103 including two from distant locations (background), where an influence of the local pollution sources was excluded.

All samples were analyzed on the content of heavy metals and petroleum products.

According to the results of soil survey, anomalously high chromium concentrations

were found at the urban territory (Sergeev, A.P., Baglaeva, E.M., Shichkin, A.V. Case of soil surface chromium anomaly of a northern urban territory – preliminary results // Atmospheric Pollution Research, No 1, 2010, 44-49).

These concentrations considerably (up to ten times) exceeded the typical local, regional and global ones. Chromium anomaly appeared on a background of relatively low concentration of nickel, cobalt and other heavy metals that are common pollutants of the urban territories.

According to spatial distribution, two stretched spots with high chromium pollution have been recognized on the map.

Since the spots were placed within the residential territory and far from the industrial zones, it was concluded that the chromium anomaly is not associated with industrial activity. In addition, the simple calculations confirmed that the origin of this anomaly could not be explained by atmospheric deposition only.

Similar kind of chromium pollution was detected in 2008 on the territory of New-Urengoy city (Yamal-Nenets Autonomous District, Russia).

In the frames of the research project "Arctic" # 12-2-4-002 of Ural Branch of Russian Academy of Sciences (UB RAS), a mineralogical analysis of two soil samples from New-Urengoy with high chromium content was performed in Institute of Geology and Geochemistry of UB RAS (Y.K. Ivanov, V.F. Ryabinin).

The analysis showed the follows:

- mineral associations of samples and the nature of the erosion of grains, most probably correspond to the weathering bark of granite.

- the presence of chromite mineralization in rocks of this type is not typical and hardly probable.

- any signs of destruction of rocks, for which chromite mineralization manifestations are typical (such as the presence of bark rock weathering or displaced products of their fracture) are not found in the samples.

On the basis of mineralogical analysis one can conclude that anomalies of chromium in the soils of New-Urengoy and Tarko-Sale were not connected with geological conditions of these territories.

So taking into account all outcomes, there is a reason to believe that these anomalies were caused by unauthorized placement of chromium containing waste on investigated areas some time ago.

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