TOWARDS A SUSTAINABLE RUSSIA

ENVIRONMENT AND HEALTH

CONTENTS

HUMAN HEALTH DAMAGE FROM ENVIRONMENTAL POLLUTION

A key trend in ecological policy is evaluation and minimization of damage to natural systems, flora, fauna, and human health. Prioritizing environmental problems are largely based on the degree of manifestation of economic damage.

Depending on objectives posed, damage can be determined at the macrolevel, i.e., for Russia in general (districts or economic regions), mesolevel (by constituent member of the Russian Federation), and microlevel (a municipality, city district, or territory exposed to the discharges of an enterprise or industrial zone). Damage evaluation results are then used to develop socioeconomic programs and the relevant priorities of nature-protective measures and settlement development plans and to compensate judicially damage (loss) caused by the polluted environment to human health.

Evaluation of the economic consequences of damage to human health from the effects of the polluted environment solves the following problems:

- identifying indicators that characterize such damage (for example, additional mortality, morbidity, invalidity, and other changes in human health);
- comparative evaluation of the influence of unfavorable risk factors of environmental pollution on different human health indicators;
- cash appraisal of human health indicators.

Additional mortality, morbidity, or invalidity caused by a given environmental pollution are usually used as the main indicators that characterize damage to human health from environmental pollution. Such indicators are used in many national and international investigations. Based on them, the main derivative indicators are calculated, such as disability-adjusted life years (DALY), lost due to temporary disability, invalidity, or early mortality, and quality-adjusted life years (QALY), «weighed according to their quality».

The first indicator accounts for losses because of early death. The latter is defined as the difference between the actual age at the time of death, the life expectancy at this age, and the loss of healthy life years as a result of temporary disability and invalidity. The concept's main idea is the quantitatively generalized assessment of the state of health of different age groups of the population. The indicator of "standard expected life years lost" is used for the assessment. When loss is evaluated in case of human death, the key value (parameter) is loss per one life year lost. Damage from the loss of an entire life is calculated as a discounted sum of all life years lost.

It is necessary to use the second indicator because life expectancy itself does not reflect the level of human health. It is important how active a person is physically and socially.

An integrated approach is sound when solving problems at the federal, regional, and, partially, municipal levels. The advantage of this approach is that aggregated valuations do not need large statistical data in addition to mortality tables and sample sociological surveys with a small number of questions in the questionnaires.

Prioritizing environmental problems are largely based on the degree of manifestation of economic damage.

The «component» approach is more applicable to solving municipal, city-district, or individual-enterprise problems. Among the advantages of this ap-

proach is the accuracy of resulting evaluations fixed to the place and time of such valuations.

Cash appraisals include the calculations of both costs and losses of a seek person and his/her family due to the loss of health or life and the costs and losses suffered by society because of health disorders. These costs include the value appraisal of human life losses and health loss to determine the size of the relevant compensations, including the judicial determination of the latter. In addition, the size of damage is divided into two parts: compensation of the material losses of the sufferer or his/her family related to death or disease and additional compensation for moral damage. Societal costs are the evaluation of benefits foregone in the form of underproduction of the Gross Domestic Product due to early mortality or disability.

Thus, damage from morbidity, mortality, or invalidity includes the following components:

- medical care costs, including outpatient and inpatient treatment, rehabilitation measures, and sanatorium-resort treatment;
- temporary or permanent disability compensation costs of people who lost their health (life);
- additional compensation to the sufferer (or his/her family) if this disease or death are proved to be related to the impacts of the polluted environment, for example, lawsuits of those who suffered from the impact of fluorides, mercury, etc.;
- benefits foregone for society due to disability as a result of disease (death).

When determining the sizes of damage, both immediate direct costs and remote losses are taken into account:

- immediate direct costs include medical-care, rehabilitation-measures, and sick-leave costs;
- remote losses are additional losses due to decreased labor ability in a remote period and other late effects after treatment, i.e., degradation of human life quality, as well as the number of years (days) of lost healthy life.

The following conventional indicators are usually used in the calculation:

(a) The «conventional valuation of life value» in economic terms. According to expert economists, such conventional valuation in Russia may fluctuate from US $0.3 million to $1.0 million with purchasing-power parity (PPP) taken into account (with a life expectancy for the both sexes of 65 years in 2002), and the conventional valuation of one year, from US $4700 to $15 400. Unlike the evaluation of total damage, the compensation for health or life loss is calculated individually. Recommended conventional average values may serve as source (basic) values for making such decisions.

(b) The conventional valuation of "disease value" is the value of treatment costs and Gross Domestic Product losses. This valuation is viewed as the bottom line of real costs, since other cost categories are ignored. The latter include the costs of suffering from the disease, the readiness of individuals to pay for the prevention of disease risk, the preventive household costs, etc.

(c) The conventional "value of invalidity" is estimated according to the size of retirement benefits, the costs of conducting medical-labor (medico-social) examination, the costs related to employment and professional training of invalids, and prosthetics and prosthetic design costs, as well as retirement-home and asylum costs.

Let us give several examples of economic valuation of health loss from the effect of polluted environments. The total loss of human health from water and atmospheric air pollution in certain years was estimated at 2.3–3.4% of Gross Domestic Product. This valuation agrees with valuations of the World Bank experts [Macroeconomic Valuation of Human Health Loss from Environmental Pollution for Russia // Bobylev S.N., Sidorenko V.N., Safronov Yu.V. et al. – Moscow.: World Bank Institute, Nature Protection Fund.– 2002. –32 p.].

In Russia, about 7 million people are ill with bronchial asthma – a «manifest» disease reflecting the effect of the atmospheric air. According to the most conservative estimates, the annual damage from this factor may be US $400–600 million. However, these estimates do not reflect further health and relevant economic losses.

Another type of health damage is the effect of such widespread substance as lead. An increase in its content in the blood of preschool-age children by 1 mcg/dl leads to the retarded intellectual development of a child. In addition, negative consequences may show even 10 years after lead impact in early childhood. Economic losses from lead concentrations in the blood higher by 1 mcg/dl per child are estimated in the United States at about $1200. In Russia, 2 million children may show excessive lead concentrations [Bykov, Revich, 2002].

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ECONOMIC CONSEQUENCES OF NATURAL AND ANTHROPOGENIC DISASTERS

Polls show that Russian public consciousness views Russia as a country of calamities and catastrophes, in which the emergency situation ministry is the main governmental body for solving the people's pressing problems. Mass media information about practically daily emergencies, on the one hand, forms and enroots this image and, on the other, makes people get accustomed to them and perceive actual tragedies increasingly less emotionally and more cold-bloodedly. In addition, these polls prove that the vast majority of Russians regard natural and anthropogenic disasters as considerably less significant than everyday socioeconomic risks associated with low incomes, unemployment, crime, and so on.

At the same time, the actual picture, although hardly prosperous, is far from being apocalyptic. This means that we should not fatalistically expect even worse times but take coordinated measures instead in order to develop an economy resistant to natural and other catastrophes.

Analysis of the dynamics of natural and anthropogenic disasters over the last 15 years (1991–2005) and their damage to the country's economy shows the following. While the total numbers of such catastrophes and their victims tend to decrease, the number of sufferers on the whole is increasing and material losses are growing more rapidly compared to this (according to certain estimates, by 10–15% annually on average). These losses are mainly (about 70%) due to economic damages from natural disasters and catastrophes, annually averaging from 3 to 7% of the Gross Domestic Product in the late 1990s through the early 2000s[1].

This is far from the myth of Russia as a "center" of calamities and catastrophes and characterizes it as an organic part of the world community, whose economic development and emergencies are characterized by tendencies typical of the world as a whole. In turn, this determines common reasons for strengthening and differentiating the vulnerability of the economy to calamities and catastrophes. At the same time, this includes specific Russian conditions that do change, sometimes to a considerable extent, the way in which the above reasons show up, adding specific features both to calamity and catastrophe risks and, primarily, to the vulnerability of the Russian economic system to these risks.

As for the world dynamics of economic losses from natural and anthropogenic calamities and catastrophes in postwar years, the following tendencies are noteworthy.

[1] Yu. L. Vorob'ev, "The Main Trends in the National Risk Control Strategy at the Turn of the 21st Century," in The Sixth All-Russian Scientific and Training Conference "Emergency Risk Control," Moscow, March 20–21, 2001. Reports and Presentations (Kruk, Moscow, 2001), pp. 12–21; Catastrophes and Society, pp. 45–46; M. A. Shakhraman'yan, V. A. Akimov, and K. A. Kozlov, Estimate of Russia's Natural and Anthropogenic Safety: Theory and Practice (Moscow, 1998), p. 15; V. I. Osipov and A. L. Ragozin, "Identification and Forecast Evaluation of Russia's Strategic Natural Risks," in Risk Control (A Special Issue) (2002), p. 66.

Admittedly, the strategy aimed at mitigating the adverse tendencies should be based on a modified concept of sustainable development, which is fully formulated in the Hyogo Declaration of 2005. In addition to the conventional formulation of sustainable development, linking current tasks with interests of future generations and economic problems with ecological ones, this concept implies requirements on reducing the risks of natural, anthropogenic, and social disasters and catastrophes.

In this case, the specified goal of the national strategy may be formulated as sustainable development that ensures economic growth and reduces the integral risk of natural and anthropogenic disasters and catastrophes. This interpretation implies that we should choose economic development that could help strengthen public resistance to emergencies, primarily at the expense of reducing individuals' vulnerability to well-known everyday socioeconomic risks and, respectively, improving living standards and protection from any dangers.

In the first place, the number of the most disastrous emergencies and economic losses from them are growing. The growth rates of this damage exceed those of the Gross Domestic Product production. Over the last 40 years, the number of natural catastrophes alone with a damage of more than $1 billion each increased more than four times[2] .

According to other data, the number of natural catastrophes, the damage from each of which exceeded 1% of the aggrieved country's Gross Domestic Product, increased more than four times (from 16 to 66) over only 25 years (from 1965 through 1990). Over the same period, the number of emergencies, in each of which suffered more than 1% of the aggrieved country's population, increased 3.5 times[3]. The above tendency is characteristic of the new century as well. For example, from 2000 through 2004, the annual average number of emergencies with an economic damage of more than $60 million each exceeded the respective indicator for the 1990s by 15%.

As for the economic damage, over the last 40 years, the total direct losses from the most disastrous natural catastrophes alone increased more than 15 times, while the world Gross Domestic Product increased only four times. In 2002, total losses from them exceeded $55 billion (compared to $36 billion in 2001 and $30 billion in 2000).

If the existing tendencies last, the average annual economic damage from 2000 through 2010 may reach unbelievable $150 billion, which is three times higher than in the 1990s, while the gross world product, according to certain estimates, will increase only 1.7 times[4]. This means that the world economy in the near future will remain unable to compensate economic losses from calamities and catastrophes, spending increasingly more resources on overcoming their consequences and a decreasing share of resources on reproducing material values and improving life quality.

The above major change in the impact of catastrophes on the world economic system shows up in a number of other equally significant tendencies. One of them is the outrunning growth of economic losses from emergencies compared to the growth of the number of catastrophes themselves, which testifies to the growing scale and accelerating rates of their disastrous impact on major production factors. The actual scale of the damage considerably exceeds the above figures concerning the most significant natural catastrophes, taking into account the great number of minor emergencies (with a damage of less than $60 million each), both natural and anthropogenic. The world statistics does not present such data.

According to our estimates, the total direct damage from all emergencies, disasters, and catastrophes at the turn of the centuries was about $180 – 190 billion annually. These figures do not include indirect losses, as well as ecological losses, which would increase them by more than an order of magnitude.

It is also noteworthy that economic consequences of relatively smaller emergencies may be even more fatal for national economies, because they show up at local and regional levels, which are the main sources of real capital. In addition, owing to their relatively lower significance (compared to consequences of major catastrophes), they attract less attention of the mass media and national and international organizations responsible for aiding in catastrophes and, consequently, fewer resources for restoring economic activities.

Another tendency is associated with a total or general character of the growth of economic losses from emergencies, which on the whole has been sustainable, increasing in countries of the "golden billion" (about 60% of economic losses from natural catastrophes fell on them in the 1990s), as well as in developing and postsocialistic countries. Unfortunately, there is little statistics illustrating such dynamics at national and regional levels. However, the example of the United States is demonstrative, where the number of major catastrophes alone (with a damage of more than $1 billion each) increased two times and the total damage from them, almost eight times over the last 20 years.

The universal character of the growing disastrous impact on economies is evident from unprecedented direct losses of $100 billion, suffered by Japan from the earthquake of 1995. A similar damage was inflicted by cyclic climate changes (the El Nino effect) in 1997 – 1998 to the economies of practically all countries of North and South Americas. An unprecedented damage of $18 billion from huge floods was suffered by countries of Western and Central Europe in 2002[5].

Still another world tendency is a stable and significant prevalence of natural disasters and catastro-

[2] Munich Re Group, E&F/Geo, February, 2000.

[3] V. I. Osipov, "Scientists' Focus on Natural Catastrophes," in Herald of the RAS 65, 484 (1995).

[4] Calculated according to: The World at the Turn of the Centuries: Forecast of the World Economy's Development Until 2015, Ed. V. A. Martynov and A. A. Dynkin (Novyi vek, Moscow, 2001); Natural Catastrophes and Man-Made Disasters in 2000: Fewer Insured Losses Despite Huge Floods (Sigma, 2001, № 2), pp. 3–18; Munich Re, in Press Release (December 30, 2002), pp. 1–4.

[5] Calculated according to: Natural Catastrophes and Man-Made Disasters in 2000: Fewer Insured Losses Despite Huge Floods (Sigma, 2001, № 2), pp. 3–18.

phes in the formation of the economic damage from emergencies. From 1970 through 2000, 70–75% of the total damage from emergencies to the world economy fell on natural disasters and catastrophes. The share of these disasters and catastrophes in the total number of emergencies never exceeded 40%, varying primarily about one-third. The remaining part of the total damage from emergencies falls on anthropogenic catastrophes, including large-scale fires, explosions, and acts of terrorism (which are also attributed to emergencies by international insurance companies and specialized UN institutions).

However, it would be improper to understate the significance of the adverse impact of anthropogenic, including technological, emergencies and catastrophes on the development of society.

The disastrous impact of relatively small-scale everyday emergencies on the natural and resource potential is great. The negative effect of major catastrophes is also considerable. The direct economic damage from Chernobyl was $10 billion in the former Soviet Union alone, while only insured losses from the events of September 11, 2001, in the United States were about $40 billion. The latter indicator exceeded the total damage from natural catastrophes (about $30 billion in 2001) for the first time in the postwar period, which decreased the total Gross National Product growth rates of industrially developed countries by 0.5 percentage points down to 2.5%, the lowest indicator after 1993.

Finally, still another important tendency in the field under analysis is a steady growth of the number of sufferers from natural catastrophes under a noticeable decrease in the number of victims. Over the last decade of the past century alone, the number of sufferers from these catastrophes across the world increased two times, averaging 188 million people annually. This is almost three times higher than in the 1970s and six times higher than the number of sufferers from armed conflicts in the 1990s. Compared to the 1970s, the number of victims decreased almost in the same proportion (three times), from 210 000 to 70 000 annually on average. On the whole, the number of sufferers from natural catastrophes over the above decades exceeded 4 billion people and the number of victims, 3.5 million people[6].

In our opinion, the strategy aimed at mitigating the above adverse tendencies, should be based on a modified concept of sustainable development, formulated in full in the Hyogo Declaration of 2005. In addition to the conventional formulation of sustainable development, linking current tasks with interests of future generations and economic problems with ecological ones, this concept implies requirements on reducing risks of natural, anthropogenic, and social disasters and catastrophes.

In this case, the specified goal of the national strategy may be formulated as sustainable development ensuring economic growth and reducing the integral risk of natural and anthropogenic disasters and catastrophes. This interpretation implies that we should choose economic development that could help strengthen public resistance to emergencies, primarily at the expense of reducing individuals' vulnerability to well-known everyday socioeconomic risks and, respectively, improving living standards and protection from any dangers.

[6] Calculated according to: Ibid.; Munich Re Annual Report 2001 (Munich, 2002), p. 17, 69; "Living with Risk: Focus on Disaster Risk Reduction," in UN IDRS (2001), p. 49–50.

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ENVIRONMENTAL HEALTH RISK INSURANCE

The most important and commonly recognized international principle of environmental safety is obligatory compensation of environmental and human damage. The Russian Civil Code envisages that "enterprises that damage the environment, human health, and property by polluting the environment must fully compensate the damage." Pollution losses must be compensated from owner's equity.

According to the law, industrial enterprises are not only to compensate health damages but also to prevent further losses (diseases, deaths, and disability). Loss prevention means preventive measures that exclude or decrease negative health risks.

Under present conditions, when polluting enterprises lack necessary funds and budgetary resources are insufficient at all levels, the problem of preventing and compensating for health losses from environmental pollution is insolvable. More than 80% of inflicted losses are not compensated at all.

Apparently, part of them may be prevented and compensated by using the risk insurance principle. Lawyers and economists have been arguing the application of environmental or sanitary and epidemiological insurance of health risks associated with environmental pollution.

Any management decisions on risks imply certain costs. The social character of risk management implies activities on the prevention of damage-forming factors; in other words, measures are taken both before and after a damage-forming event, and, in addition, administrative risk control is continually under way. Accordingly, costs may be divided into preevent, postevent, and current.

The preevent risk financing implies the costs of forming reserves and insurance payments before damage (disease).

The postevent financing appears as a necessity to pay for inflicted damages. In the presence of insurance, it pays only for uninsured risks.

The current risk-management financing consists of administrative costs of ensuring risk monitoring and estimation.

Based on the social significance of health risks and sound doubts in the possibility of cash compensation for clinical outcomes, we may conclude that preevent costs have priority in the health risk control system. At the same time, with regard to the existing Russian legislation on damage compensation (including health damage compensation), the postevent financing should be in the form of legal mechanisms.

All methods of acting on risks may be divided into three major groups: risk reduction, risk conservation, and risk transfer.

Risk reduction down to certain conditions implies different variants.

Risk avoidance, the most important strategic goal, is ensured by organizational and technical or administrative (legal) measures. As applied to health risks because of environmental pollution, this may be industrial reequipment, conversion, and evacuation from hazardous areas.

The most important and commonly recognized international principle of environmental safety is obligatory compensation of environmental and human damage.

If risk avoidance is technically or financially impossible, measures are taken to reduce the risk level (the probability of adverse effects). This variant may be realized if there are legally determined levels of acceptable health risks.

Risk conservation at the existing level does not mean that it should be ignored altogether; this choice may imply the formation of a system of monetary compensations to those who are under health risks, rehabilitation medical measures, financial responsibility regulations (taxation, quotation, and licensing), and so on.

Finally, risk transfer means that responsibility for risks is transferred to third parties. One of its variants is insurance (the insurance of responsibility before people under risk).

According to cash flow discounting theory, funds whose inflow or outflow does not coincide in time with decision making are of a lower weight than the outflow during damage formation. The optimal way is to enter risk-management expenses during the preevent period; i.e., the most profitable way is to ensure health risks.

The cash value of risk in the environmental health risk management system makes it possible to implement health risk insurance programs associated with anthropogenic impacts. The economic evaluation of the health risks of people who live in areas affected by industrial enterprises makes it possible to determine the value of possible health damages and to work out an insurance system of compensations (economic, medical, rehabilitation, and others).

The point of this system is to form a totality of distributional and redistributional relations envisaging different forms of measures aimed at overcoming or compensating health damages (both in cash and in kind).

The formation of state-controlled insurance funds makes it possible to solve a number of problems that cannot be solved by individual risk-inducing enterprises or groups of enterprises because of existing financial restrictions. The moneys of this fund are divided into three groups in accordance with the above cost types and are used for measures on liquidating or reducing health risks (preventive, technical, and others) and on compensating damages to all participants of the health protection system or an individual.

There are two forms of such insurance: voluntary and compulsory.

The voluntary form is based on a voluntary contract between the insured and an insuring entity. The insurance company determines the insurance procedure and conditions independently.

It is noteworthy that voluntary insurance does not imply any restrictions with regard to insurance money and insurance payment rates. The only condition to be observed is the following: the greater the pollution and health risk the higher are insurance payment rates. Insurance payments are made out of profit. The system of compulsory insurance is less flexible. Compulsory insurance is carried out according to the law that envisaging the procedure and conditions of this type of insurance.

The obligatory condition is the presence of a regional or federal list of potentially hazardous activities and agents (enterprises) subject to health and pollution risk insurance. This form of insurance regulates insurance money and insurance payment rates. It implies that insurance payments should be included into the cost of products (works and services) of the insurer, which will increase the enterprises' interest in this type of insurance.

Note that compulsory insurance is more effective than voluntary one, because in this case, insurance covers all sources of pollution, which increases chances that sufferers will receive compensation for damages inflicted by environmental pollution.

However, the following hinders the introduction of compulsory insurance:

- the lack of the necessary legislation framework for introducing compulsory insurance and the lack of developed methods for this kind of insurance;
- there is no methodological basis for the economic evaluation of health damages and actuarial calculations in the field of health risk insurance;
- there are no budgetary funds necessary to form the national insurance fund.

With regard to the above, it is first purposeful to approve the mechanism of voluntary health risk insurance and then to introduce compulsory insurance step-by-step.

The insurer and the insured should obligatorily be mutually interested in preventing emergencies and damages to the environment and health. Both parties have their own insurance interests: the insured party is interested in receiving compensations for direct and indirect losses, while the insurer is interested in profit.

The insurance system should cover the regional and federal levels through the formation of insurance funds. The formation of the system of funds in a region is oriented towards real economic potentialities to compensate damages (under the modern conditions, the compensations are involuntarily low), and its importance is in the guaranteed (necessary) character of such compensations. The funds are equally important for ensuring the economic inter-

est of enterprises in reducing health risks from their economic activities.

The insurance contract envisages that the insured party pays established insurance payments to the insurer, while the insurer, under the occurrence of loss, compensates damage according to the insurance money (damage limit) determined in the insurance contract and the duration of insurance.

The insurance contract may envisage other conditions, particularly the reduction of insurance premiums if insurance measures are taken, reducing the probability or the expected scale of the inflicted damage, as well as the participation of the insurance fund in the financing of the above measures. A part of insurance premiums (the nonoccurrence of loss after a definite period or risk reduction by the insurer) may go back to the enterprise in question.

Insurance makes both parties equally interested in emergency risk reduction. The insured party is interested in the safety of its activities because, in addition to all other factors, as the probability of emergencies grows, the insurance premium rates grow too; moreover, the insured party receives a number of benefits for fail safety: a part of the insurance premium is paid back, the insurance contract is prolonged on easy terms, and so on.

The insurer is even more interested in risk reduction and takes a number of preventive measures in this respect, such as the environmental audit of the insurer's state. The insurer is obliged to spend a part of the difference between the sum of the collected insurance premiums and that of insurance compensations paid for the ecological or sanitary and epidemiological audit of insurers, the improvement of the environmental monitoring service, and other needs.

Compulsory allocations for environmental, sanitary, and epidemiological insurance at the expense of payments for pollution and a decrease of tax revenues in regional nonbudgetary funds make a legal basis for local authorities to use a part of these funds for financing regional preventive measures. All the parties should observe the principle of commercial application, envisaging that the fund resources should be increased whenever possible.

In our opinion, methods of the economic evaluation of health risks (the calculation of insurance turnovers) for insurance purposes should be based on the following approaches:

1. Total financial losses because of health damages comprise direct losses (costs of treatment, remuneration losses, and so on), indirect losses (losses associated with underproduction, profit losses, and so on), and the monetary expression of life quality losses.
2. Direct losses are accounted for in all types of insurance, while indirect losses and life quality losses are accounted for in compulsory risk insurance, a part of them being a component of insurance funds formed for insuring risks.
3. The sum of insurance payment is determined on the basis of the epidemiological morbidity assessment during the previous period, the calculations being corrected according to the scale of health risk.
4. Payments collected by insurance companies are spent on measures aimed at evaluating health risks and reducing them.

The implementation of the insurance system will make it possible to receive additional funds for rehabilitation measures and to form additional economic mechanisms for reducing anthropogenic impacts on the environment.

To effectively realize the economic mechanism of preventing and compensating health and pollution losses, it is necessary to develop and improve the legal framework of insurance.

The development of insurance requires that the following tasks should be solved rapidly: to classify risks subject to insurance; to establish limits of the material liability of legal persons for potential damages; and to develop methods of quantitative (monetary) evaluations of health and environmental economic damages.

The development of a system of sanitary and epidemiological audit (the legal status of auditing organizations, accreditation, and voluntary endorsement of service) should be an integral part of the insurance system. Regular sanitary and epidemiological audits by the enterprise in question, combined with the health risk insurance of third parties, may become a brand of a socially oriented enterprise in the near future.

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«HOT SPOTS» OF CHEMICAL POLLUTION ON THE MAP OF RUSSIA AND PUBLIC HEALTH

One of the objectives of environmental policy and environmental epidemiology is to pinpoint "hot spots" related to the impacts of various environmental factors. We may assume that the number of "hot spots" on Russian territory is significantly large.

However, it is difficult to establish their true number due to the high labor intensity of obtaining all necessary and authentic information and the low number of epidemiological findings. Nevertheless, there has been certain progress in the awareness of the situation over the last 15 years. The Russian ministry of natural resources has largely contributed to this by issuing a document on the criteria of ecological emergency zones. The status of such a zone is assigned to a city by the resolution of the Russian government based on the opinion of the state environmental appraisal.

In Russia to date, 11 cities have received this status. Among them are cities with high levels of environmental pollution with benzo[a]pyrene, such as Bratsk (Siberia) and Kamensk-Ural'skii (the Urals) with the well-developed aluminum industry, Magnitogorsk with the world's largest metallurgical plant (the Urals), Novocherkassk with Europe's largest electrode factory in the south of Russia, as well as the "lead cities" of Krasnoural'sk and Karabash in the Urals, the "dioxin" city of Chapaevsk in the mid-Volga region, and others. No doubt, this list is far from being complete, and, according to our expert estimates, the number of such cities may be significant (up to 50–70).

Unfortunately, epidemiological studies have not been conducted in all of these cities, and if they have, they are mainly of a descriptive nature. A large number of descriptive epidemiological studies were performed in Perm', Orenburg, Volgograd, and some other oblasts of Russia.

Analytical epidemiological studies are mainly being developed in regions where the Environmental Epidemiology component of the World Bank's project to improve the quality of the environment has been previously conducted or international projects are being conducted. These are Sverdlovsk oblast in the Urals, the city of Cherepovets in the Northwest, and international projects on the Kola Peninsula and other arctic territories, conducted by the Northwestern Center of Public Health jointly with the colleagues from Norway, Denmark, and Finland. Moreover, an international project on the "dioxin" city of Chapaevsk has been implemented for approximately 10 years, and some projects with international participation to determine lead in the blood of children have been realized.

The papers presented at the 2005-2006 Moscow Forums of the Nation Health League contained the results of the analysis of certain epidemiological studies of the impacts of such priority substances as heavy metals (lead, nickel, mercury), arsenic, dioxins, and benzo(a)pyrene. Naturally, this is not the complete list of the main pollutants.

One of the objectives of environmental policy and environmental epidemiology is to pinpoint "hot spots" related to the impacts of various environmental factors.

Discharges of styrene, 1,3 butadiene, carbon bisulfide, vinyl chloride, hydrogen chloride, chloride, methylmercaptan, ethylbenzene, and many other substances get into the atmospheric air of many cities together with discharges of industrial enterprises. In addition, the number of cars

has sharply grown over the last 15 years. This particular source of discharges takes the lead against the discharges of factories and power plants in large cities.

Heavy Metals: Lead

The highest levels of environmental pollution with lead are characteristic of settlements where its smelting facilities are located. Many industries still use obsolete technologies.

The estimation of the risk of the negative impact of the lead-polluted environment based on the United States Environmental Protection Agency's biokinetic model has shown that the lead content in the blood of approximately 1.9 million children in 120 cities of Russia may exceed the accepted «alarming» level of 10 mcg/dl [Bykov, Reich; 2001].

The determination of lead in the blood of children who live in different regions of Russia close to metallurgical enterprises has proved the forecast estimates. The most unfavorable situation has been in the cities of Karabash, Krasnoural'sk, Belovo, Dal'negorsk, Rudnaya Pristan', and in the vicinity of the storage-battery facility in Saratov.

Mercury

Especially hazardous are the manufacturers of caustic soda who use mercury as a cathode.

For example, two enterprises in the Lake Baikal region used 3200 t of mercury over 30 years; more than 40 t were drained to the Angara River; and 78 t, to the atmospheric air [Rikhvanov, 2000], which led to the pollution of the riverbed sediments and water of the Bratsk storage reservoir. The highest pollution is observable near Balagansk village of 4200 inhabitants, in whose ration the share of fish is 25–30% [Efimova, Rukavishnikov 2001], which is an extremely high indicator for Russia. As a result of excessive consumption of polluted fish, the daily mercury intake exceeded several times the standards recommended by the United Nations Food and Agriculture Organization and the World Health Organization.

These villagers are characterized by an excessive mercury content in hair and urine. The villagers underwent certain psychoemotional changes – high situational and personal anxiety, retarded logical thinking and abstraction factor, weakened memory and attention, and neurotic phenomena [D'yakovich, Efimova, 2001].

Nickel

The world's largest nickel-ore mining and processing metallurgical complex is located on the Kola Peninsula in the northwest of Russia; the discharges of this metal together with the wastes of metallurgical factories are also significant in the Ural cities of Verkhnii Ufalei, Rezh, and Orsk and the Siberian city of Noril'sk. In Monchegorsk, the morbidity with bronchial asthma, asthmatic bronchitis, anemia, and gastritis among children is high [Spazhakina, 1983].

The impact of atmospheric pollution from the mining and metallurgical complex Pechenganickel on the environment and health of people living on the border between Russia and Norway has been studied intensively in recent years. Excessive levels of nickel content in the urine of the inhabitants of Russian settlements on the Kola Peninsula have been identified, compared to the Norwegian population. In Nickel village and the cities of Zapolyarnyi, Apatity, and Kirovsk, respiratory symptoms were much more frequent among both men and women than among the inhabitants of the Norwegian province [Bykov, 1997].

Arsenic

An excessive level of environmental pollution with arsenic is possible in Ural cities where copper-smelting (cities of V.Pyshma, Krasnoural'sk, Kirovgrad, Revda, Karabash, Mednogorsk, and Orsk) or gold-mining enterprises (Plast city, Chelyabinsk oblast) are located.

Fluorides

The highest pollution level has been recorded in Nadvoitsy village (Karelia). Changes in the musculoskeletal system characterize exposure to fluorides due to their tropism toward bone tissue. In this village, orthopedic pathologies were observable in 70% of the examined persons, which is 3.8 times higher than the average frequency of these diseases. The frequency of acquired deformations of the locomotor system exceeds 15.9 times (!) the regional averages mainly due to acquired deformations of the lower limbs [Andrianov et al., 1995]; fluorosis was diagnosed in 93% of children [Rakhmanin et al., 2001].

Benzo(a)pyrene

The main industrial enterprises that discharge benzo(a)pyrene are 14 aluminum factories, 9 coke factories, and large metallurgical enterprises; in addition, almost half of the discharges of this substance is the result of coal combustion by households.

The highest benzo(a)pyrene concentrations were recorded in the atmospheric air of cities with aluminum, coke, and steel factories in the Urals (Magnitogorsk, Nizhniy Tagil, Kamensk-Ural'skii, Krasnotur'insk, and Chelyabinsk), Siberia (Novokuznetsk, Krasnoyarsk, Bratsk, Shelekhovo), near the largest power plants in the south of Russia (Novocherkassk), in Siberia (Nazarovo, Cheremkhovo, and Kansk), or in Siberian and Far Eastern cities with many coal-driven boilers. Approximately 14 million people are exposed to benzo(a)pyrene concentrations in the air higher than 1 ng/m3, i.e., every Russian.

Excessive lung cancer morbidity in men was proved in polluted districts of Magnitogorsk [Koshkina, 1997] and in a small Ural city of Karpinsk, located close to an aluminum factory, [Katsnel'son et al., 2004].

Organochlorine Pesticides

The number of pesticides used in Russia is constantly decreasing, which is preconditioned by the economic situation in the country, the efficiency of environmental policy, and adoption of the relevant legislation.

Descriptive epidemiological papers, which studied southern regions of Russia, show significant changes in reproductive health, including late menarche, menstrual period disorders, miscarriages, a high frequency of gynecological, obstetrical, and prenatal pathologies, disorders in rates and timings of physical and sexual development of girls [Kirbasova, Ponomareva, and Lopatina, 1996, Mashaeva and Fedorovich, 1991, and other authors].

Polychlorinated Biphenyls (PCB)

The indicator of PCB impact on human health is the content of these substances in human biomedia.

In the breast milk of women in the city of Serpukhov, where PCB were used, their concentration is higher than among other examined groups of the population. Excessive morbidity of children, changes in the blood clinical picture, and disorders in the reproductive health of women were revealed on territories adjacent to the capacitor factory. The "case – control" method helped to identify the environmental pollution with PCB as a risk factor of infertility.

Dioxins

The presence of these substances is characteristic of urban environments where chloride chemical enterprises are stationed.

Among general populational groups, the highest dioxin content in breast milk and blood was found in the inhabitants of Chapaevsk, some cities of Bashkortostan, Usol'e–Sibirskoe. Analytical environmental and epidemiological research in Chapaevsk proved the role of dioxins as risk factors of developing breast cancer and reproductive health disorders [Revich et al., 2002, 2003, 2005].

In order to conduct an efficient environmental policy, use financial resources rationally, and reduce the number of environmentally dependent diseases and other human health deviations, it is necessary to establish national and regional lists of territories with high levels of environmental pollution. This is possible on the basis of generalization of data collected by various controlling organizations and the results of research institutes.

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DEVELOPING INTEGRATED ENVIRONMENTAL MAPS

Environmental mapping is mostly industry targeted with a view towards the visual reflection and analysis of the status of only one environmental component and, consequently, do not reflect complex unfavorable environmental impacts on the territory under study and human health. This task needs the development of integrated environmental maps, which should be viewed as a state-of-the-art method of combining multifactor information on environmental changes at individual sections of the territory under study and on the extent of human health risks due to environmental pollution.

Such investigations were conducted by our team led by Prof. B.N. Malikov, who had largely contributed to the development of the fundamentals and methodology of complex environmental maps. His main idea was to integrate (i.e., select, generalize, and combine) multifactor information on the special distribution and quantitative parameters of individual environmental contaminations that are present within a mapped locality on a single mapping basis. Such combined reflection of all the main environmental factors that operate on the territory under study makes it possible to conduct environmental zoning of this territory and evaluate the aggregate impact of natural and anthropogenic ecological factors on both the quality of the environment and the health of the local population. However, the main point is that integrated environmental maps help establish the interrelation between the environmental situation prevalent in a given locality and the incidence of different local environmentally conditioned pathologies.

The most advisable is the development of integrated environmental maps for those territories within which the high concentration of industries is permanently, heavily, and complexly affecting the environment and human health. In other words, we are speaking about the cartographic pinpointing and description of stable source areas of anthropo-environmental tension. The main objects of complex environmental mapping can be large city territories (mapping scale from 1:10 000 through 1:100 000); a city with the adjoining industrial zone, or urban agglomerations (scaling from 1:50 000 to 1:200 000); a whole administrative region, characterized by a large number of industrial cities, including those specializing in specific industries and inflicting specific damage to the environment (scale less than 1:200 000).

According to our estimates, the development of integrated environmental maps is a multiphase process, which includes the following steps:

1) Acquisition and collation of data on the status of the main natural components of the territory being mapped (water, air, soils, radiation situation) and their contamination sources.

Here, to obtain information about changes in the above components influenced by different anthropogenic contaminants and environmental factors, all available methods and means of data acquisition are used (from visual observations to aerospace monitoring methods). Obtained data are reflected in a series of industrial environmental maps, each of which characterizes one type of contamination. Such series may include up to 10–12 maps.

Environmental mapping is mostly industry targeted with a view towards the visual reflection and analysis of the status of only one environmental component and, consequently, do not reflect complex unfavorable environmental impacts on the territory under study and human health. This task needs the development of integrated ecological maps, which should be viewed as a state-of-the-art method of combining multifactor information on environmental changes at individual sections of the territory under study and on the extent of human health risks due to environmental pollution.

2) Representing obtained environmental data on a complex ecological map.

The task of the second phase of development of integrated ecological maps is the combined reflection of all main areas and contamination indicators of individual natural components on a single complex environmental map. This allows us to summarize the main contamination sources and key environmental factors that operate within the territory being mapped.

3) Medical and environmental probing of the territory under study.

The goal of this phase is to calculate statistical indicators that reflect the level of human health risks due to environmental contamination in a given territory.

At the initial zoning phase, based on complex environmental map data, the whole territory of a work site is divided into a large number of (about several hundreds) cells, each of which is characterized by a certain combination of several unfavorable environmental factors, reflected on the complex environmental map.

Below is a sample list of such factors, operating on the territory of a large community with developed industry and a population of more than one million:

- Atmospheric fallouts (tons per square kilometer).
- Hazard class of contaminants according to their toxicity for human health.
- Atmospheric discharges of motor transport (grams per second per 1 kilometer of roads).
- Soil contamination with heavy metals (by the ZC complex index).
- Annual dosage of human exposure to ionizing radiation (millisievert).
- Radon concentrations in soil (kilobecquerels per cubic meter of soil).
- Presence of electromagnetic radiation sources.
- Presence of tectonic faults.
- Presence of dumps.
- Presence of ash dumps.
- Gamma background level (microroentgens per hour).

Then, a complex evaluation of environmental factors is given on the basis of system analysis. In addition, the notions of qualimetry are used, not only the primary qualities of factors are considered but also their pro rata contribution. The weightage of each environmental factor is established by the method of expert appraisals, and then the complex index of hazard extent (I) is calculated for each local site.

It is calculated by the formula:

$$I = \frac{\sum_{i=1}^{n} a_i * k_i}{n}, \quad (1)$$

where I is the complex index of hazard extent of a territory,

I is a given environmental factor,

N is the total number of factors (in our case, N =11),

a_i is the share of factor contribution under the condition that $a_1 + a_2 \ldots a_n = 1$,

k_i is the extent of factor intensity:

1 is acceptable (the factor value equals the maximum permissible concentration or the background value); 2 is moderate; 3 is higher than usual; 4 is high.

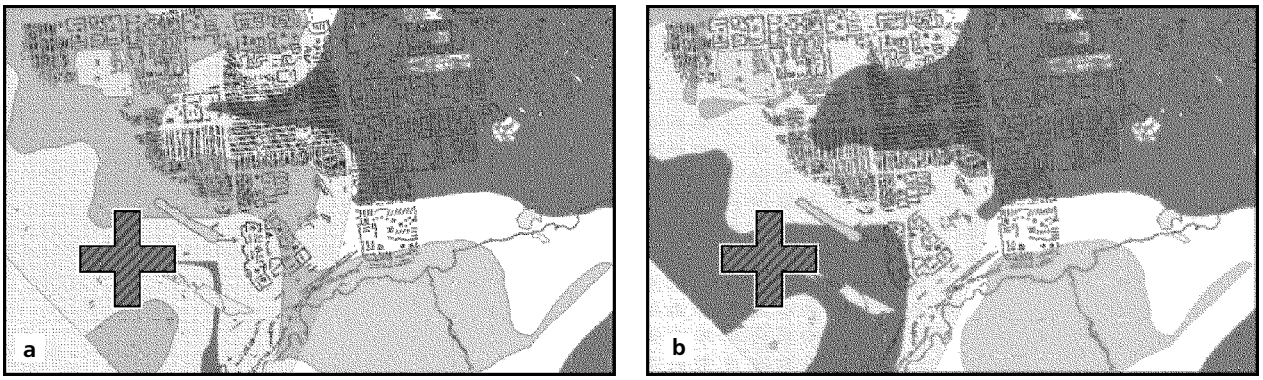
A procedure that finishes the process of medico-environmental probing is the territory gradation according to the I complex index value. Our practices yielded the following classification:

- I value is more than 2, a high contamination extent (corresponds to a zone with a high-hazardous level of environmental contamination for human health);
- I value is from 1.5 to 2, a higher than usual contamination extent (corresponds to a zone with a hazardous level of environmental contamination);
- I value is from 1 to 1.5, a moderate extent of contamination (corresponds to a zone with a low-hazardous level of environmental contamination);
- I value is less than 1, a low extent of contamination (corresponds to a zone with a relatively low exposure to anthropogenic impacts).

4) Modeling and reflecting the boundaries of zones with different human-health risks on integrated environmental maps.

Here, depending on the complex index value, all territorial cells are grouped into three zones characterized by different extents of environmental risk for human health:

- Zone I is a highly hazardous level of environmental contamination and a high environmental risk for human health;
- Zone II is a hazardous level of environmental contamination and a medium risk for human health);



A forecast of changes in the environmental situation in a district of the industrial center if a new industrial facility is located on this territory.
(a) Environmental situation before the construction and
(b) environmental situation after the construction. The cross shows the location of the industrial facility. The changed environmental situation is shaded.

- Zone III is a low-hazardous level of environmental contamination and a relatively low risk for human health.

In order to visualize these zones on the map, the "quality background" mapping method is used, when colors are selected by the "traffic lights" principle: the red light for zone I (high hazardous), yellow for zone II (hazardous), and green for zone III (low hazardous). Territories that are relatively little exposed to anthropogenic impacts are not colored.

In addition to the fact that integrated environmental maps demonstrate complex information on environmental pollution and its impact on human health in a clear, compact, and easily interpretable graphic way, they are also an important source for the development of environmental measures:

- to improve the quality of the environment and protect the health of the local population;
- to plan and implement medical preventive measures of environmentally dependent diseases;
- to optimize the location of different daycare and medical facilities;
- to evaluate the advisability of the construction of new stationary industrial facilities, transportation roads, and other anthropogenic objects that adversely affect the environment of mapped territories;
- to plan new long-term residential development in an ecologically clean zone;
- to locate recreational zones, health farms, and preventive clinics.

We see a rapid development of modern computers and GIS technologies, as well as their wide application and active use in environmental management and nature protection. Therefore, the development of integrated environmental digital maps is the basis for improving the principles and methods of the system of complex ecological monitoring and medico-environmental forecasting of the status of the territory of the industrial center by health and well-being criteria.

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USING GIS TECHNOLOGIES TO EVALUATE THE URBAN ENVIRONMENT QUALITY BY CHILD ECOPATHOLOGIES

The main criteria of environmental well-being of a territory are still the quality of human life and the level of human health. It is the category of health that is viewed now as an indicator of conformity between environmental characteristics and scientific and technological progress. Yu.P. Gichev (1998) sees human health as the main bioindicator of environmental risks and an important component of environmental monitoring.

Human response to significant environmental changes takes the form of different environmentally induced diseases.

The organism of a child is the most sensitive to hazardous environmental impacts on health due to its anatomical and physiological features (children are more susceptible than adults to hypertension and exhaustion of adaptive mechanisms, significant changes in the functions of organs and systems, etc.). Inborn development defects and malignant neoplasms are called "markers of environmental ill-being in a region." The World Health Organization declared infant mortality a key factor of human health.

In order to analyze the quality of the environment on the territory of Kaluga city, we used the address data of child morbidity, selected from the dispensary logbooks of primary-care pediatricians on the territory of the city itself without residential suburbs included in the municipal formation the «City of Kaluga.» Since the morbidity data are medical secrecy and the specific names of children, as well as apartment numbers where they lived, were of no interest for the research results, a child was assigned a conventional «number» and the following data were recorded: sex, age, address (street number), diagnosis, disease duration. The following ecopathologies according to the Gichev classification (1994, 1995) with additions were chosen as bioindication parameters:

- indicative ecopathologies (malignant neoplasms, inborn development defects, bronchial asthma);
- environmentally dependent pathologies (obstructive recurrent bronchitis, pneumonias (acute and chronic), infant mortality, total child mortality); and
- environmentally induced pathologies (iron deficiency anemia, urinary system diseases).

Morbidity indices were calculated and analyzed for the following diseases: malignant neoplasms, iron deficiency anemia, bronchial asthma, inborn development defects, pneumonias (acute and chronic), bronchitis, and the total morbidity index.

Cartographic models with the boundaries of territories served by children outpatient clinics allow us to see graphically the situation ratios at different city territories. Thematic computer maps were generated on their basis: a map of children outpatient affiliates, child morbidity

An ecomedical examination of an urban territory, unlike any other methods, was able to reveal territories unfavorable for human health.

maps by each disease, and mortality maps. The classic medico-geographic approach implies such analysis. However, analysis based on the administrative zoning of the city by the service zones of children outpatient clinics does not reflect the actual special medico-geographic regularities. It is too rough and arbitrary.

In this situation, the most detailed and accurate way of determining favorable and unfavorable city sections in terms of environmental quality is the special analysis of the administrative addresses of ill or late children (street number). Such an address analysis generalizes the results over several years and clarifies the situation in each specific territorial point. With the help of GIS technologies, morbidity cases are spotted on the city map. A spot cluster characterizes an unfavorable situation in such sections.

For an accurate mathematical analysis of the territory in terms of child morbidity with address tie-ins, we developed and applied the data density modeling method. Since these data have no numerical expression but the character of their geographic distribution is meaningful, we developed a method that allows us to evaluate the special distribution of data by the distance between neighboring points, but first, the data density index should be calculated.

The data density index is calculated as follows:

$$p = \frac{\sum_{i=1}^{n} l_i}{n},$$

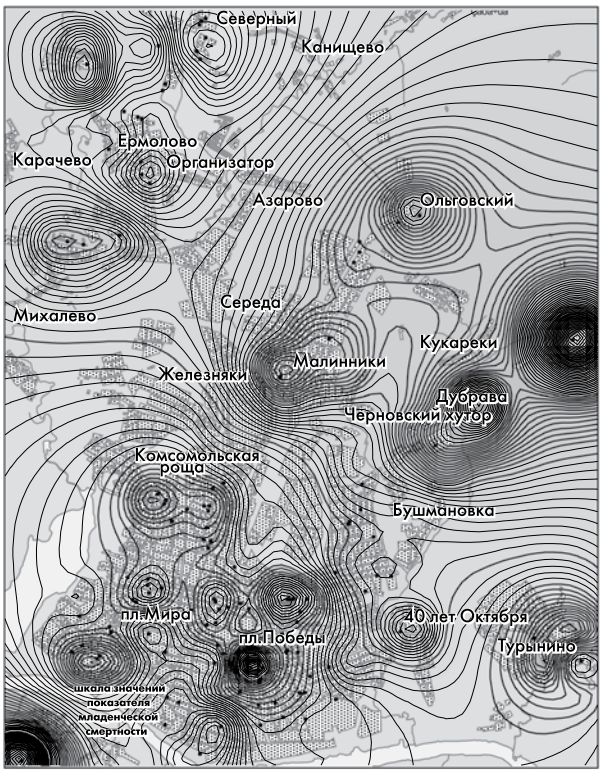
where:

p is the data density index;

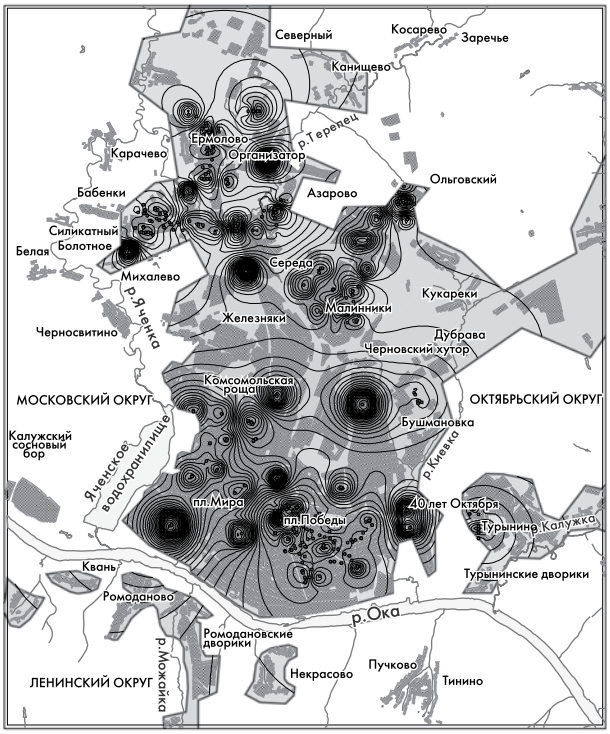
l is the distance from the point analyzed to the nearest point; and n is the number of nearest points.

The index shows the extent of congestion (density) of data points and the average distance to the neighboring points; consequently, the smaller its value the denser are the grouped data. The index is expressed in absolute linear units of distance between neighboring points, doers not depend on data character and quantity and the size of territory under study, is, consequently, applicable not only to disease analysis but also to the modeling of other point data, and is comparable to data of different nature (character).

The index thus calculated for each point, a mathematical model of isolines is constructed with the help of the interpolation method; this model is superimposed on the map of a city territory under study; and we obtain a data density map.



Spatial distributions of child mortality on Kaluga territory



Spatial distribution of child morbidity with anemia and bronchial asthma on Kaluga territory

We also developed an algorithm of data entry, storage, and processing, which includes both widely used computer software and specially designed program modules: Microsoft Office Professional, Excel, and Access for database entry and editing and specially designed program modules to calculate specialized indices, Surfer for the calculation of the mathematical surface, MapInfo for medico-geographical and bioindicative mapping.

Before examining the specific distribution of child health indices on Kaluga territory, it is necessary to bear in mind that the distribution of child health indices is very uneven on the city territory, which, in turn, speaks about the environmental heterogeneity of the territories.

We calculated the total index of the infant mortality data density for Kaluga territory over 1993–1998 and constructed a model of the special distribution of this index in the form of an isoline map.

The analysis of the special distribution of infant mortality indexes revealed several vast unfavorable ecological spots on the city territory. Environmentally favorable territories are located in the eastern and northeastern parts of the city and suburbs.

The special distribution of child ecopathologies on Kaluga territory correlates well with the city zoning by favorable environment, obtained with the use of arboreal plants as bioindicators.

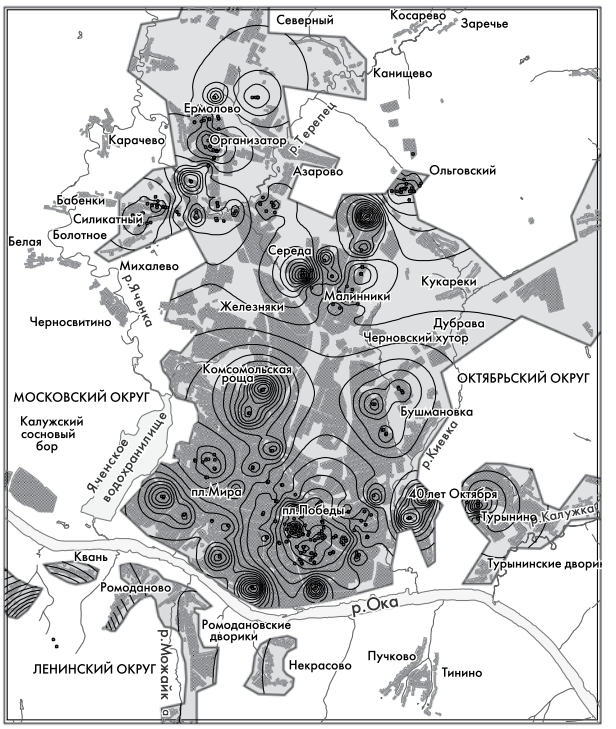
As a general conclusion, we may say that the bioindication by both arboreal plants and child health reveals the following qualitatively unfavorable environmental sections on Kaluga city territory.

The district of Kubyaka includes Silikatnyi, Turynino, the eastern part of the territory serviced by the central children outpatient clinic, and a very small area on the territory of the Malinniki village.

At the time of the research, neither the Sanitary and Epidemiological Administration, nor the specialized environmental bodies, nor the Hydromet monitoring service revealed any significant anomalies in those places (at least, there is no official information on this).

Thus, the ecomedical survey of the city territory, unlike any other methods, helped identify territories unfavorable for human health.

To simplify this analysis and monitor the quality of urban habitat continuously, we recommend to introduce the continuous monitoring of children health based on GIS technologies (we have preconditioned its development).



Spatial distribution of morbidity with inborn development defects on Kaluga territory

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HYGIENIC AND ENVIRONMENTAL PROBLEMS OF RURAL PUBLIC HEALTH

The current state of health among the rural population is characterized by negative tendencies in all age groups. The aging of the rural population continues, which is determined by falling birth rates and mortality growth. A decline of natural population growth is observed in all the Volga regions. Depopulation considerably decreases the nation's creative potential because of the increasing share of elderly and disabled people. In the long run, this also aggravates the lack of labor resources in the country's agricultural sector.

The unfavorable demographic situation in rural areas, negative health indicators against the background of growing socioeconomic problems, and the decline of medical service have largely predetermined the decrease of life expectancy among agricultural labor. In addition, these negative tendencies require that the Russian health care bodies increased the role of preventive medicine. In this respect, the problem of labor conservation and a longer labor capacity comes to the fore and becomes the most topical, because in recent years, considerable drawbacks in labor protection and hygiene among agricultural employees have led to a high occupation-related morbidity and traumatism.

The above problems were caused by nonobservance of sanitary requirements for workplaces; and drawbacks in the system of the state supervision of normative and legal acts regulating sanitary and other issues in the new forming socioeconomic conditions. Many environmental problems that came to the fore during the last decades both in industry and in agriculture remain unsolved.

At the same time, we know that health is not only an integral indicator of life quality but also one of the most significant economic factors. The preliminary evaluation of economic costs related to examinations and compensations for damage to health has shown that they amount to 6-7% of the labor compensation fund at different enterprises. In Russia as a whole, occupation-related damage to health may reach 4 to 5% of the Gross National Product.

In order to improve the sanitary situation, the Saratov Research Institute of Rural Hygiene has solved a number of important problems associated with the normative and methodological base of sanitary control in rural settlements and the substantiation of curative measures aimed towards the improvement of labor conditions and life of the rural population, as well as the improvement of the environmental situation. An important document is "Methods of Sociohygienic Monitoring," developed by the Russian Ministry of Health and Social Development, which is based on our systemic model of the region's sociohygienic monitoring. This model allows us to obtain the value of the contribution of environmental factors to the formation of indicators of the rural population's health. This makes it possible to work out a program on preventive measures with regard to the region's characteristic features and ecological specifics.

At present, the most important problem is substantiation of the impact of environmental factors on human health. World Health Organiza-

The sanitary well-being of Russians is guaranteed by Federal Law FZ 52 On Sanitary and Epidemiological Well-Being, according to which criteria of safety or harmlessness of the habitat are ensured. If we do not take measures to observe this law, it will remain merely a good intention on a piece of paper for the majority of rural citizens.

tion experts state that 20% of all diseases are determined by the impact of environmental factors. Probably, this figure reflects the problem correctly relative to European countries (under their standards, norms, strict control, etc). Taking into account the character of our "economic" activities and the underdevelopment of many legal, economic, social, and labor aspects, the share of the contribution of unfavorable environmental factors to poor health may be higher.

Today, the most complicated and costly task in the world is to reduce the negative impact of the environment (which, as a rule, is made worse by people themselves) on human health.

Many investigations conducted by the Saratov Research Institute of Rural Hygiene show that the most risky factors in rural areas are water, soil, atmospheric air, and foods. Taking into account environmental characteristics of these areas, the ranking of the above factors may vary. In response to our request to 30 centers of the Russian Public Health Authority, all of them answered that the problem of good potable water on their territories is the most acute among all.

Note that so far, more than a half of rural inhabitants use potable water that does not meet hygienic requirements according to the chemical or bacteriological indicators. Many rural settlements have no central water supply and many are not equipped with modern water-conditioning systems. Hence, the population in many rural areas gets unsafe water through the distribution network directly from rivers, ponds, and reservoirs. Naturally, this tells on the health of the rural population.

Pesticides are especially dangerous for rural inhabitants. Despite a considerable decrease in their use, these biologically active compounds remain one of the powerful impacts on the human organism.

Qualitative and quantitative analysis of using pesticides in Saratov oblast over the last two decades has shown an order of magnitude reduction in their use and changes in their assortment. However, there are pesticides of the new generation, which are characterized by a lower consumption rate but are more aggressive, and their impact on the human organism has not been examined to a sufficient extent. Hence, experience shows that it is not always possible to predict consequences, especially when these preparations are used in protected ground vegetable farming in which female employment is more than 95%. According to our data, the total load is 24 to 59 kg/ha. It has been discovered that women employed in this sphere suffer from not only disorders of cardiovascular and nervous systems and the gastrointestinal tract but also serious changes in the reproductive system (disorders in the menstrual and genital functions), which is of the highest social importance, especially under the present demographic crisis.

The institute's experience shows that, despite the reduction in the use of pesticides compared to previous decades, these persistent organic pollutants should be regarded as the most hazardous for human health. This is confirmed by the institute's large-scale investigations conducted in Russian grain growing areas, where pesticides were widely used in previous years. It has been discovered that, in addition to the worsened indicators of adults' health, this has an extremely negative impact on children. Hence, studying the impact of new, especially foreign, preparations, sometimes with no hygienic approval, on the reproductive function is of great sociohygienic importance.

In addition to the above problems of rural hygiene, there are other equally important issues whose solving is hindered by the insufficient financing of scientific developments. They include soil hygiene, waste utilization on cattle farms and complexes, aged pesticides and chemicals, and the optimization of the planning structure of modern rural settlements, including housing, new production objects, and so on. It is necessary to develop a new normative and methodological base accounting for modern conditions in rural areas and requirements of technical regulations that are being introduced.

It is possible to solve the above problems of rural areas only if all interested bodies, irrespective of their departmental subordination, unite their efforts. Most likely, this may be reached only if there is a republican program. There are certain prerequisites for this due to the fact that the development of the country's agricultural complex has been included in the priorities of the state policy.

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ENVIRONMENTAL PROBLEMS AND HUMAN HEALTH IN LENINGRAD OBLAST

No doubt, negative trends in the state of health of the Leningrad oblast population certainly depend on changes in the environmental situation. At the same time, determining the real impact of this factor remains a complex scientific and practical problem. Its solution needs the use of state-of-the-art chemical, physical, biological, and epidemiological methods; the efficient interaction of all departments and structures that deal with environmental and humanhealth problems; and relevant financing. In our view, it is wrong to economize in this area, because an effective policy of sustainable development in a region should be based on scientifically justified provisions and conclusions. Economizing on prevention, we would lose many times more on the recovery of natural resources, medical treatment of people, aid to invalids; and an increase in nonrenewable losses from the death of natural ecosystems and depopulation.

Leningrad oblast is one of the largest territories in the Northwestern district. Its population is 1.6 million, two-thirds of which are urban dwellers.

The catchment area, which exceeds 50 000 km^2, with well-developed industry, agriculture, and transport, makes the water system extremely vulnerable, especially in karst zones (Volosovsk, Lomonosov, Gatchina, and Boksitogorsk districts), and determines the risk of the water factor impact on human health.

Among the natural characteristics of the oblast that largely form human pathologies are the excessive soil radon content on more than one-third of its territory and the uneven distribution of such crucial microelements as iodine, fluorine, cadmium, nickel, and manganese.

The location and industrial development of more than 80 deposits of bauxites (in the east of the oblast), oil shales and phosphorites (in the west), granite (in the north), limestone, fireclays (in the center), and peat (in the south and east) have become the main city-developing factors of large industrial centers in Vyborg, Volkhov, Gatchina, Kirishi, Tosnensk, Slantsy, Kingisepp, and Boksitogorsk districts and preconditioned their tense medico-environmental condition.

The demography of this territory is characterized by a high density of population within the radius of 60–80 km from St. Petersburg (up to 200–800 inhabitants per km^2), the resultant wide range of environmental and hygienic problems, as well as a very high settlement dispersion outside this zone (up to 10 inhabitants per km^2), especially in eastern and northeastern districts of the oblast.

The location of St. Petersburg within Leningrad oblast and the socioeconomic integration of the city and the oblast have generated such problems as air and water basin pollution, positioning the most hazardous industries and dumps in suburban districts, a significant increase in anthropogenic loads on the oblast in the summer period due to the mass migration of city dwellers to the health farms and dacha conglomerates of Vsevolzhsk, Vyborg, Volkhov, Kirovsk, Luga, and Tosnensk districts, although in general the atmospheric air pollution on the territory of Leningrad oblast remains moderate and has a local nature.

Zones of the worst pollution of the atmospheric air from stationary pollution sources are located in the mining and processing industrial centers – the cities of Kirishi, Slantsy, Luga, Gatchina, Svetogorsk, Volkhov, Syas'stroi, Boksitogorsk, Pikalevo, and Kingisepp, as well as on the territories of Vsevolzhsk, Gatchina, Kirovsk, and Lomonosov districts, located within the 40-km zone of the St. Petersburg influence.

Among the main negative trends that influence the level of atmospheric air pollution are the contribution of motor transport to air pollution and the persistence of transborder transfers of pollutants from the territories of Estonia, Finland, Karelia, and St. Petersburg.

In 2004, state sanitary and epidemiological control bodies selected and studied 53 917 atmospheric air samples on the territory of Leningrad oblast as to their compliance with hygienic standards, and 299 of the samples did not comply with the standards (0.6% of the total number of the studied samples).

As for the state of the water basin, it is noteworthy that in 2004 state sanitary and epidemiological control bodies sampled 747 water probes on the territory of Leningrad oblast from water reservoirs of category I as to their compliance with the sanitary and chemical standards, 19.8% of them did not comply with the standards. As for microbiological standards, 776 samples were tested, 112 of which (14.4%) did not correspond with the standards.

As for water reservoirs of category II, in 2004, 2572 water samples were selected and probed for the compliance with the sanitary and chemical standards; 572 of the samples (22.2%) did not comply with the standards. 20.9% of 1222 samples did not comply with the microbiological standards.

In 2004, 1049 sources of centralized water supply were monitored on the territory of the oblast, 19.2% of which did not meet the sanitary standards and rules; 85.6% of them due to the absence of sanitary protective zones. In rural settlements, 20.9% of 724 sources did not comply with the sanitary standards, 85.4% of which due to the absence of sanitary protective zones.

The 2004 investigations of water quality in the centralized water-supply sources revealed that 24.0% of the samples did not comply with the sanitary and chemical standards and 17.01%, with the bacteriological standards. The main sanitary and chemical indicators of the source water quality nonconformity are color, turbidity, iron content, and hardness.

In 2004, 11 917 water samples from the distribution water-supply network were tested in terms of the sanitary and chemical indicators. 19.6% of them did not comply with requirements SanPiN (Sanitary Regulations and Norms) 2.1.4.1074-01 «Potable Water» The main indicators of nonconformity with the norms were color, turbidity, odor, acid capacity, and iron content. In some districts, iron content in the distribution network exceeded the norm in 90% of the samples.

By the bacteriological indicators, 9.0% of the samples did not meet the SanPiN requirements.

The sanitary and technical condition of 62 (18,2%) out of 340 communal water pipelines did not meet the sanitary regulations and norms. In rural settlements, 18.1% of 277 water pipelines did not comply with the sanitary norms.

In communal water-supply pipelines, 20.3% of 9881 water samples tested did not meet the sanitary and chemical standards.

The technical condition of 28.1% of 1365 sources of decentralized water supply did not meet the sanitary regulations; 34.2%, the sanitary and chemical norms of water; and 32.6%, the microbiological standards.

The oblast cities and settlements generate up to 530 000 t of municipal solid waste (MSW) annually, including more than 400 types of waste. Out of them, 362 types belong to hazard classes 3 and 4 (about 80 groups according to the Temporary Regional Waste Codifier for St. Petersburg and Leningrad Oblast). Their main amount falls on the permanent population: 487 600 t (92%); during the summer months, the waste amount increases by 8% due to the dacha population.

In recent years, the situation with sanitary cleaning aggravated in the oblast cities and settlements where several departments and entities deal with these problems due to departmental disunity.

The main problem in organizing waste utilization is the insolvency of entities and institutions. In connection with this, they delay to sign or do not sign at all contracts with service utilities for solid waste disposal, trying to solve these problems themselves, which leads to the emergence of small unauthorized dumps at wastelands, in residential green zones, and in road windbreaks or the combustion of household waste in containers and on open sites in residential developments.

In the majority of districts, MSW are disinfected unsatisfactorily, because, in the overwhelming majority of cases, unplanned dumps are used for these purposes, whose sanitary and technical condition does not meet the current sanitary requirements and, as a rule, they are sources of intensive soil, water, and air pollution. Cases of spontaneous waste fires are recorded at these nonregulated sites.

The leading radiation factor for the Leningrad oblast population is still radiation from natural sources, which is 75.7% of human exposure to all sources of radiation, the Russian average indicator being 69%. The second most important factor of human exposure to radiation is medical radiation, which is 23% (1429 man-Sv) of the human exposure level to all sources of radiation (the Russian average indicator is 30%).

The medico-demographic situation on the territory of Leningrad oblast over the past 10 years indicates a continuous depopulation process. Natural population loss, caused by a low birthrate and high mortality of the oblast inhabitants, and the unfavorable regressive-type age structure of the population in combination with uneven distribution of people across the Leningrad oblast territory determine the difficult medico-demographic situation.

In 2003, population losses due to natural decline were the highest in the last 13 years, amounting to almost 22 000 people, or 13 persons per each thousand of inhabitants against the country's average of 6; in addition, the number of the dead in the oblast exceeded that of newborns 2.6 times (the similar indicator for Russia was 1.6).

Mortality in the oblast is still one of the highest in the Northwestern District, and, according to the St. Petersburg State Statistical Committee's data, in 2004, 33 613 deaths were registered on the oblast territory (the crude mortality rate is 20.3 per 1000 persons). Deaths exceeded births 2.5 times. This high mortality level is partially explained by the continuous aging of the oblast population. Inhabitants of the retirement

age are 22% of the population, the Russian average being about 20%. Despite the general aging tendency in the country, this process in Leningrad oblast is more vivid.

The main reasons for human death are still the diseases of the blood circulation system, traumas, poisonings, and neoplasms.

The average longevity of the Leningrad oblast population in 2003 was 61.7 years, which is 4.7 years less than in 1998; in addition; the general longevity (GL) of men decreased by 5.3 years and that of women by 2.9 years over this period. On average, the female population of the oblast lives 14.6 years longer than the male population, which is primarily related to male supermortality, especially in the working age.

Intensive indicators of general child morbidity in 2004 were 140 149.8 per 100 000 children; that of teenagers, 89 333.6; and that of adults, 37 388.3 per 100 000 persons of the respective category. Morbidity indices for the children on the Leningrad oblast territory were registered at 179 798.5 per 100 000 persons; for teenagers, at 137 650.6; and for adults, at 79 318.8.

The leading ratings in the primary morbidity structure for children are still held by respiratory diseases (89 359.6 per 100 000 persons), infectious and parasitic diseases (7330.2 per 100 000 persons), skin and hypoderm diseases (6278.7 per 100 000 persons), traumas, poisonings, and some other consequences of external impacts (6269.3 per 100 000 persons), and eye and its accessory apparatus diseases (4606.5 per 100 000 persons).

Rating Leningrad oblast districts by the important classes of diseases and individual nosological forms that exceeded the regional level in 2004 allowed us to identify districts with high levels of morbidity practically in all age groups - Tikhvin, Tosnensk, Kirishi, Gatchina, Lomonosov, Lodeinopol', Luga, and Slantsevsk districts.

High levels of morbidity with malignant neoplasms in the oblast are registered in Kirishi, Boksitogorsk, and Slantsevsk districts, where morbidity indices exceeded the oblast level 1.3-1.5 times. These particular districts are characterized by a high level of anthropogenic loads on the environment.

For the female population of Leningrad oblast, the leading localizations in the structure of malignant neoplasms were breast cancer (21%), other skin neoplasms (10%), and stomach neoplasms (9.7%). For the male population of the oblast, the most topical are still the malignant neoplasms of the bronchopulmonary system (23.3%) and stomach (12.5%). There are reasons to believe that widespread tobacco smoking and atmospheric air pollution predetermine the former.

In 2003, 238 800 people lived exposed to chemical pollutants of the atmospheric air in concentrations from 2 to 5 of the maximum allowable concentration (MAC); moreover, almost 33% of them experienced the toxic effects of inorganic dust, containing silicon dioxide (Vyborg and Priozersk districts); approximately one-fifth of the population had to be exposed to excessive concentrations of nitrogen dioxide (Svetogorsk city and Slantsevsk district). The majority of the Kingisepp district population lived on territories exposed to suspended substances, 1510 persons in Vyborg district were exposed to 2-mercaptoethanol in concentrations of 2-5 MAC. Note that 22 940 inhabitants of Vyborg and Priozersk districts lived on territories where the concentrations of 2-mercaptoethanol and inorganic dust, which contained silicon dioxide, exceeded 5 MAC.

In 2003, 483 985 inhabitants of Leningrad oblast drank potable water that did not meet the chemical safety requirements; 875 605 persons, the microbiological safety requirements; and almost 165 252 persons had to drink potable water of excessive hardness. Note that the deterioration of the potable water quality is possible at the stage of natural pollution of water sources (Kingisepp, Kirovsk, and Gatchina districts), changes in the processes of water treatment and preparation (Kirovsk, Kingisepp, and Vsevolzhsk districts), and at the stage of potable water transportation to the customer (Kirovsk and Podporozhsk districts).

Unfortunately, practically one-tenth of the population exposed to chemical substances in potable water drank water with the excessive (> 5 MAC) content of contaminants (ammonia and ammonia ion, chlorides (by Cl), sulfides, and hydrogen sulfide (by H2S)).

No doubt, the negative trends in the state of human health in Leningrad oblast are certainly related to changes in the ecological situation. At the same time, the measurement of the real level of impact of this factor remains a complex scientific and practical problem. Its solution requires the use of state-of-the-art chemical, physical, biological, and epidemiological methods; the efficient interaction of all departments and structures that deal with environmental and humanhealth problems; and relevant financing. In our view, it is wrong to economize in this area, because an effective policy of sustainable development in a region should be based on scientifically justified provisions and conclusions. Economizing on prevention, we would lose many times more on the recovery of natural resources, medical treatment of people, aid to invalids; and an increase in nonrenewable losses from the death of natural ecosystems and depopulation.

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ENVIRONMENTAL AND HYGIENIC ASSESSMENT OF THE AREA NEAR THE MISSILE LIQUIDATION CENTER

In accordance with the Agreement on the Destruction and Safeguarding of Weapons and the Prevention of Weapons Proliferation between the United States and Russia of July 17, 1992, liquidation of ground-based intercontinental liquid fuel missiles, removed from combat duty, is carried out on a site in Nizhni Novgorod oblast.

Taking into account the fact that missiles subject to liquidation contain residual highly toxic rocket fuel and the population of nearby settlements is worried about the potential adverse impact of the operation of the Missile Liquidation Base (MLB) on the environment, an environmental monitoring system was included in the base reconstruction project in 2000.

The State Nizhniy Novgorod Research Institute of Hygiene and Professional Pathology, The Russian Ministry of Health (parent organization), the Federal State Organization "Center of the State Sanitary and Epidemiological Supervision in Nizhniy Novgorod Oblast," Nizhniy Novgorod State University named after N.I. Lobachevsky, the Federal State Organization "Forest Protection Center of Nizhniy Novgorod Oblast, and the Volga Regional Center of the State Monitoring of Subsurface Resources "Volgageologiya" participated in the development of the operational ecological and hygienic monitoring program.

The program to conduct the operational environmental and hygienic monitoring of the Missile Liquidation Center's activities was approved by the Federal State Organization "Chemicals Transportation Design and Engineering Center of Rosaviakosmos (Russian Aviation and Space Agency) and agreed with the Head Office of Natural Resources and Environmental Protection of the Russian Ministry of Natural Resources in Nizhni Novgorod oblast.

In accordance with the approved program, the operational environmental monitoring includes three modules.

The first module envisages the environmental and hygienic monitoring, including the control of gas and air emission sources, atmospheric air of the industrial site and settlements, waste water, underground and surface waters, soil, snow, and flora.

The second module includes biological monitoring and bioindication of the fauna, including amphibians, small mammals, birds, and insects, as well as the biological monitoring of forest communities by geobotanic and forest pathology criteria.

The third module is medico-environmental. It is based on health-state estimates by mortality and morbidity indicators (major disease classes, oncological diseases, and pregnancy and birth pathologies).

While identifying admixtures of oxidation products of asymmetric dimethylhydrazine (ADMH) in fire gases forming under the thermal deactivation of asymmetric dimethylhydrazine -containing gas-air mixtures and waste water, it was established that gas-air emissions to the environment may contain both asymmetric dimethylhydrazine and its oxidation products: nitrosodimethylamine (NDMA), dimethylamine (DMA), dimethylformamide (DMFA), and formaldehyde (FA).

The results of the three-year environmental, hygienic, biological, and ecotoxicological monitoring and bioindication show no manifest changes in the environment around the Missile Liquidation Center.

Ventilation exhausts forming during the cutting of missile bodies and fuel tanks may contain aerosols of metals: aluminum (Al), manganese (Mn), magnesium (Mg), copper (Cu), chromium (Cr), and nickel (Ni). Hence, operational environmental monitoring includes testing all samples for the above organic substances and aerosols of metals.

Within the environmental and hygienic module, more than 5300 samples were collected and 10760 tests were carried out in 2004. The results of the analytical monitoring of gas-air emissions were estimated with regard to not only concentrations of substances under analysis in each source but also the observance of maximum permissible emissions (MPE) approved by environmental protection bodies for the Missile Liquidation Center.

The dynamic laboratory tests did not show excesses in the established maximum permissible emissions of asymmetric dimethylhydrazine, nitrosodimethylamine, and dimethylamine. The total gross emission of all substances under analysis did not exceed the approved maximum permissible emissions. A similar situation is observed relative to the content of aerosols of metals in ventilation exhausts.

The observance of gross maximum permissible emissions of organic substances and aerosols of metals in sources of air-gas emissions is confirmed by monitoring the test results of the atmospheric air in the industrial site and settlements. The operational monitoring did not show excesses of maximum permissible concentrations in the atmospheric air of the industrial site and settlements.

According to the sanitary control methodology regarding the impact of industrial activities on the quality of subsurface waters, it is important to organize a system of laboratory control in the network of observation wells. Hence, the operational environmental monitoring program includes the drilling and installation of six observation wells located between the industrial site of the Missile Liquidation Center and two subsurface sources of potable water.

The six observation wells form three clusters installed on the upper and lower parts of aquifers. The laboratory control results did not show the presence of asymmetric dimethylhydrazine, nitrosodimethylamine, dimethylamine, FA, Cu, Cr, Ni, and Al in any sample over the three years of observations. The content of Mn and Mg in all the observation wells does not exceed the hygienic norms for potable water.

Environmental and hygienic investigations of snow and soil are important methods of estimating the impact of industrial activities on the environment.

The snow samples were collected in March. They were collected from the industrial site, sanitary protection zone, and settlements. Thirty-nine samples were tested for asymmetric dimethylhydrazine, its oxidation products, and aerosols of metals. The results did not show the presence of asymmetric dimethylhydrazine, nitrosodimethylamine, and formaldehyde in any sample. Dimethylamine was present in 50% of the samples, but its concentration was lower than the hygienic norm for household water use basins. The content of nitrates and aerosols of metals also did not exceed the hygienic norm.

On the whole, the ecological and hygienic monitoring results for 2004 show that the hygienic situation in the vicinity of the Missile Liquidation Center is favorable.

According to the biomonitoring indicators of freshwater and surface ecosystems, the environment within a radius of 10 km from the Missile Liquidation Center is estimated as "relatively satisfactory."

These investigations demonstrate the necessity to conduct a complex environmental, hygienic, biological, and medico-environmental monitoring for a valid assessment of the habitat of humans, flora, and fauna. This is especially topical for places where objects operate that are potentially hazardous for the environment, including humans, and, consequently, arouse concern among people. Specialists from research organizations and institutions of higher education play an important role in information and expert assessments for the public.

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THE BLACKSMITH INSTITUTE FUND'S REGIONAL PROJECTS

The Blacksmith Institute is an international charitable fund that deals with environmental problems. The Blacksmith Institute Fund was named after the craft of a blacksmith, who works in smoke and smut for the benefit of other people. The Blacksmith Institute, trying to follow these principles, creates and supports local initiatives aimed towards solving pollution problems. This approach has to date yielded good results in a number of countries across the world.

The Blacksmith Institute was founded in 1999. Since its first day, the Fund has been operating to make its mission a reality: ensure cleanliness and well-being on our planet for the benefit of future generations regardless of their cultural or economic background. The fund focuses on the development and implementation of solutions to pollution-related problems in the countries with developing and transitional economies. Jointly with various donors and international organizations, the Fund is striving to provide strategic, technical, and financial support to local initiatives aimed towards solving environmental problems in local communities.

Environmental pollution, threatening human health, is a key problem in countries with developing and transitional economies: from unregulated sewage runoffs and unplanned dumps to industrial discharges near residential quarters and toxic leakages to urban water-supply intakes. These and similar problems cause diseases in millions of children, reduce longevity, and make our planet unsuitable for the life of future generations.

According to the World Health Organization, up to 20% of diseases in developing countries have environmental background. The current situation is aggravated by extremely poor development of initiatives aimed towards the elimination of this problem. In the absence of the relevant legislation or control over its use, polluting industry can escape punishment, which negatively tells on health. Unfortunately, local governments often do not consider the objectives of strengthening the current environmental legislation, as well as awareness of environmental health, among their priorities. We may long discuss the reasons of this phenomenon; however, it is obvious already now that the problems of municipal and industrial pollution of the environment in a number of countries need immediate and targeted responses.

The Fund's main initiative is the Polluted Places program launched in 2003. Within the framework of this initiative, the Fund gathers information about territories that suffer from environmental problems, which threaten the health of the local population. The Fund directly evaluates their conditions and jointly with local partners develops solution strategies and helps implement them. The Polluted Places program supports innovative and creative approaches to problem solving, assisting local organizations and their leaders.

We believe that problems are solved most efficiently when there is a local leader capable of finding the right solution and put it into practice. It may be an active local person, the leader of a public organization, or a local government representative. It is important that this is a per-

The Fund's key area of activity is the development and implementation of solutions to pollution-related problems in the countries with developing and transitional economies. Jointly with various donors and international organizations, the Fund is striving to provide strategic, technical, and financial support to local initiatives aimed towards solving environmental problems in local communities.

son whose life, as well as the life of his/her relatives, friends, and neighbors, will improve with the solution to the problem of a polluted area – this guarantees the best result.

Using the network of its representatives all over the world, the Fund is looking for such leaders and offers financial and technical assistance to them and their organizations in solving the existing environmental problems of their city or village. A visit of the Fund's representative to a site that suffers from environmental problems is accompanied by scrupulous analysis of the situation, meetings with representatives of the authorities in charge of the environment and environmental activists, and other stakeholders and organizations.

Our goal is to identify the force that can really change the situation for the better using the Fund's financial, technical, and organizational assistance. The Fund is especially interested in supporting local initiatives that may later attract other organizations to the struggle against pollution.

At present, within the Polluted Places program, the Fund is implementing more than 20 projects in 13 countries of the world. The project subjects cover as many areas as their geography, but they all are united by a common goal: to promote solutions to environmental problems that threaten human health.

In addition to direct actions, aimed towards the liquidation of pollutions and implemented within the framework of the Polluted Places program, the Fund also works together with local authorities and nongovernmental organizations on improving public awareness of pollution, creating databases about environmental quality through monitoring and research, and strengthens the antipollution legislation.

In our opinion, today we already have tested solutions to any, even the most complicated, problems. To find these solutions and those who will put them into practice in each particular case is one of our main objectives. Thus, the Blacksmith Institute Fund is not simply a fund in its traditional meaning, because, in addition to financial allocations for solving various environmental problems, we provide our partners with methodological, strategic, and organizational support. In order to form its wide opportunity base, the Fund operates in a number of areas. Thus, we provide the necessary resources for research into pollution-related problems and their most appropriate solutions. We cooperate with research and public organizations that are experienced in liquidating pollutions in the United States and Europe. The Fund's ramified and worldwide relations help find appropriate partners for practically any project, as well as provide assistance to organizations that are just beginning to operate.

The Fund's activities would be impossible without the support from our individual and corporate sponsors, whom we take the opportunity to thank.

We offer cooperation with Russian organizations that deal with environmental problems, which threaten the health of local populations. You can apply to the Fund with a brief description of a problem that bothers you and solutions to it, and we will by all means contact you to discuss possible joint actions.

We are sure that, by pooling our efforts, we will sooner or later reach the set goal – a clean planet for future generations!

Examples of projects implemented by the Fund in Russia:

Tomsk oblast: pesticide storage liquidation

DDT was widely used in Russia in the late 1950s to control Siberian silkworm. Despite its ban, officially adopted in the Soviet Union in 1970, the use of DDT continued until the late 1980s. Huge amounts of the unused pesticide were stored in a number of places, including Bakcharsk district of Tomsk oblast.

After the disintegration of the Soviet Union in 1991, many pesticide storages were neglected and reached an improper condition, creating a threat to the environment and human health. Thus, in 2002-2003, the Tomsk Oblast Ecological Inspectorate discovered a neglected DDT storage, located near a settlement. The pesticides partially penetrated into the environment.

The Oblast Nature Protection Committee, supported by the Blacksmith Institute Fund and assisted by a number of local groups, implemented a project of the removal and processing of the stored pesticides and thus fully eliminated the existing problem. A plan to clean out the DDT-exposed locality was developed and implemented. This location is being monitored at present.

Magadan: liquidation of a source of radioactive pollution near a city beach

In 1991, a source of radioactive pollution (cesium 137) was discovered inside an unplanned dump close to the city beach on the shore of the Sea of Okhotsk, near the Nagaevskaya Bay. It was found that the level of radioactive pollution on the beach itself exceeded the standard 10-20 times. How the radioactive materials had got to this dump remained unascertained.

The local authorities had taken steps in due time to disinfect the source of this pollution; however, since the dump (about 1 ha in area) was located on a barren slope, the radioactive materials together with rain and ice-melt waters diffused along the slope and beach territory as a result of erosive processes and even reached the Sea of Okhotsk. As a result, the radioactive materials, mixed with clay and sand, penetrated 5-7 m deep inside the slope. In order to clean the lo-

cation completely, the whole slope with a number of industrial enterprises on it had to be bulldozed down.

In 2004, the Magadan public organization Assistance - Team Work, with the Fund's financial support, organized the removal of radioactive contaminated soil sections from the slope with their burial at a relevant landfill, as well as the fixation of the slope with vegetation to avoid its erosion. The conducted studies showed the effectiveness of the undertaking: the level of radiation on the beach returned to the standard values. This location will be monitored for five years.

Nizhniy Novgorod oblast: potable water quality improvement and the development of a full-fledged environmental rehabilitation strategy

According to the data of the environmental control department of the Dzerzhinsk city administration, the quality of potable water in many urban and suburban residential quarters does not meet the safety standards. Ground and surface waters in this area have long been polluted by numerous industrial enterprises, including chemical-weapons producers.

Having tested the quality of potable water in 2004, the Fund decided to finance jointly with the city authorities a project for the installation of a water treatment plant in the village of Pyra, where the only source of potable water was highly polluted ground waters. In addition, the Fund will finance the establishment of a supervisory committee led by the Dront environmental center, stationed in Nizhniy Novgorod, and the city authorities. Among the committee's objectives will be the development of strategies for the full-fledged ecological rehabilitation of Dzerzhinsk district.

Primorskii krai: liquidation of mercury pollution of potable water

At the end of 2004, the Vladivostok city administration unexpectedly faced a problem of potable water pollution in one of the most popular recreational zones – Popov Island. The level of pollution was so high (from 8 to 40 MAC) that the authorities had to undertake urgent measures to address the problem. A new well was drilled; however, the measurements, taken after a while, showed that the content of mercury salts in faucet water was still unacceptably high (3-5 MAC). The reason for this was residual pollution: a large amount of mercury had adsorbed inside the old waterline pipes, risking the life and health of the 1500 island inhabitants and numerous tourists.

The Fund financed the replacement of 20% of the old system pipes (the remaining 80% were replaced with new pipes 2 years ago during the planned infrastructure renovation on the island and presented no hazard). The work was organized by the public organization Ecogeya and lasted for one month. Water samples after the completion of the work demonstrated a total success of the project: the mercury content in any of the samples did not exceed 0.5 MAC; other sanitary indicators of potable water were also improved.

Chelyabinsk oblast: liquidation of radioactive pollution of a territory

The village of Muslyumovo, Chelyabinsk oblast, is located on the notorious Techa River, which was heavily polluted with radioactive materials in the 1950s as a result of the Mayak chemical plant's operation. Despite the fact that more than half a century has passed since the radioactive leakages, the radioactive situation along the Techa River, which received nuclear wastes, was still far from ideal. The majority of downstream villages were resettled back in Soviet times; however, Muslyumovo was not among them. Its inhabitants continue to suffer from the excessive radioactive background, which in certain places exceeds the norm more than 10 times.

The Fund financed the work of the public organization Techa to close the riverbed sediments, which today are the main source of radioactive pollution, with fresh ground. The work was performed on a site which was inside the village territory; after this the radiation level returned to normal. This technology can afterwards be used on the remaining territory of the village.

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TOWARDS TO ECOLOGICAL MEDICINE

Topical Problems of Ecological Medicine

In terms of general biology, the acute interrelation of contemporary human health and environmental pollution is largely explained by the fact that, at the time of extremely rapidly developing ecological crisis (50-70 years), the phylogenetically ancient mechanisms of providing and maintaining compensatory and adaptive processes of the human organism have reached a dangerous contradiction with the sharply increased challenges to its adaptabilities and physiological reserves.

This happened in a historically short (compared to millions of years of human evolution) period of the formation of environmentally induced changes in the state of health and ontogenetic programs. This results in one of the most important and fundamental discrepancies between the increasing need for reliable functioning and ensuring regenerative mechanisms of the organism under the modern conditions of chronic exposure to hazardous factors of the distorted environment and the evolutionarily fixed in the past shortage of providing regenerative processes in particular (Anokhin, 1965). The latter circumstance serves today as the basic factor that restricts the organism's reliability and tolerance limits and determines the biological characteristics of the risk of developing environmentally induced modern human pathologies under the rapidly mounting ecological crisis.

Here it is important to stress that the life of the last 2-3 human generations proceeded at the time of a global geobioplanetary pathology (Gichev, 1995), characterized by the critical pollution of all environmental objects: the atmospheric air, surface and ground waters, soils, the representatives of the flora and fauna - the main human nutrition sources, as well as by dangerously high levels of contamination of the organism's internal environment, which is absolutely inadequately accounted for when treating the nature of the most widespread diseases and their initial prevention.

In terms of general biology, the acute interrelation of contemporary human health and environmental pollution is largely explained by the fact that, at the time of extremely rapidly developing environmental crisis (50-70 years), the phylogenetically ancient mechanisms of providing and maintaining compensatory and adaptive processes of the human organism have reached a dangerous contradiction with the sharply increased challenges to its adaptabilities and physiological reserves.

In addition, the content of such hazardous contaminants as heavy metals, pesticides, dioxins, polychlorinated biphenyls, radionuclides, etc., in the organism of people living in many industrially polluted regions of the country often significantly exceeds all admissible levels, which, no doubt, implies the violation of fundamental biochemical mechanisms of vitality, pressure on adaptive reactions, and changes in the pathogenesis of many diseases. It is necessary to account for the fact that the ecological background against which pathological processes are forming today has drastically changed compared to the previous decades.

To illustrate how topical and characteristic the aforesaid is of the ecological situation in Russia, it is enough to say that:

- the population of the 200 largest Russian cities with the highest pollution levels is 35-40 % of the country, which is constantly exposed to hazardous pollutants;

- the total share of the population that lives in environmentally unfriendly regions reaches 70%;
- anthropogenic pollution with toxic metals and unhealthy chemicals in seliteb zones around many industrial centers often even exceeds the concentrations of natural geochemical provinces;
- a large number of industrial cities and agglomerations have turned into the epicenters of continuous contamination of the environment and anthropogenic foci of socioecological stress and latent environmentally induced pathology of large population contingents and their progeny.

In addition, by the scale and dynamics of involvement in the pathological process of different communities, this aspect of the foci of socioecological stress is now becoming perhaps more crucial and topical than the existing problems of geochemical provinces and natural focalization of certain diseases (Yu.P. Gichev, 1996).

Under the conditions of so swiftly progressing pollution, which has fallen on the life span of only 2-3 generations, the intensive and chronic impact of unhealthy pollutants overstresses and wears out the organism's adaptive reserves, which can disrupt adaptation, develop premorbid states, and accelerate the chronization and pathomorphosis of the main pathological processes. In other words, the pressure of the distorted environment on the modern human organism already exceeds its adaptability, which has formed during the precrisis epoch; this necessitates the correction of contemporary hygienic standards and forecasts of human health (especially in relation to the intended intensification of the economic development of industrial regions).

Our long-standing medico-ecological studies in different industrial regions of the country show how drastically the environmental background has changed and deteriorated everywhere over decades, leading to an increase in environmentally induced human health disorders, changes in course patterns, symptoms, the accelerated chronization and pathomorphosis of the most widespread diseases, the extension of dystrophic and tumoral processes, the emergence of new forms of infectious pathologies, genetic predilection to chemical damages and increased chemical sensitivity, immune deficient states, and, in consequence of the above, accelerated aging and reduced longevity, which is absolutely inadequately accounted for by medical statistics, although, according to different modern authors, the contribution of the environmental component into the pathogenesis of the main diseases is from 35 to 60%.

Environmentally preconditioned and pollution-induced health disorders, in addition to their direct unhealthy effect on the organism and pollution of its internal environment, reduce the organism's general resistivity, change the aggressiveness of microbial and viral factors, increase the manifestations of chemical oversensitivity and genotoxic effects. In other words, we are speaking about the modifying effect of chemical pollutants on the course of typical pathological processes.

In this sense, we should speak about nonspecific reactions of the organism, which emerge in response to hazardous ecological impacts and increase the organism's specific reactions in response to simultaneous exposure to traditionally acknowledged and accounted for etiological factors. We may call this the mutual poundage syndrome, which has presently gained momentum but still underused when interpreting the pathogenesis of the main human diseases typical of environmentally unfriendly regions of the country. Moreover, we should stress that distorting ecological equilibrium and continuous pollution may aggravate their influence on specific human pathologies in Russia and degrade the positive effect of modern medical developments.

Unfortunately, to date a wide gap remains between the alarming results of complex medico-ecological surveys, which indicate the hazardous impact of the main pollutants on human health, and the traditional clinical interpretations of the pathogenesis of the main diseases, which were formed long before the environmental crisis. The above said is aggravated by the lack of research using the state-of-the-art methodology and methods of ecological epidemiology; certain inaccuracy, erroneousness, and large dispersion of medical statistics among different departments; underdevelopment of register technologies and personified accounting and analysis of mortality and morbidity reasons; and underdevelopment of the environmental monitoring system, including the precise methods of biomonitoring.

Consequently, acknowledging the great practical value of the pathogenetic interrelation «environmental pollution — human health» must lead to the development of a strategy of truly primary prevention and human health improvement, based on prioritized elimination and urgent resolution of hazardous environmental impacts, which is a nationwide interdisciplinary problem. The need for the development of modern problems of "ecological medicine" greatly increases in this respect.

At the same time, the term "ecological medicine" implies an important section of general human pathology and ecology aimed towards studying the specific course and pathomorphosis and evaluating, predicting, and correcting the organism's compensatory, adaptive, prepathological, and pathological states caused by physical, chemical, and biological factors of the natural and industrial environments (Gichev, 1995).

Let us briefly formulate the main objectives and trends of ecological medicine as we see them.

1. The study of the pathogenetic role and the evaluation of the extent of the contribution of unhealthy environmental factors to the origin, dissemination, and specifics of the course of the main human diseases. In addition, great attention should be paid to the description and substantiation of the modern specifics of human disease etymology, symptomatology, human disease course, and pathomorphosis affected by both individual and aggregate leading (mainly chemical) environmental factors.

2. With regard to the fact that the existing disease classification does not suit well the purposes of prompt environmental examination and forecasting unfavorable consequences of pollution, an important objective of ecological medicine should be:

   - justification, isolation, and study of environmentally induced and indicative pathologies;
   - evaluation of the information value of leading ecologically important human syndromes and diseases for environmental analysis;
   - development of adapted statistical forms and medico-ecological verification of their classification.

3. Scientifically justified use of criteria to evaluate health condition as the main bioindicator of environmental risk and ill health of territories as an integral part of the environmental monitoring system, environmental project examination, and a limiting factor. This factor should be used when developing long-term programs of socioeconomic development of the regions.

4. Development and scientific justification of the anthropo-ecological (medico-biological) block as a compulsory section of the complex environmental examination of global, regional, and local projects, which is an important and necessary objective, since the structure of the national environmental examination has so far had no formalized section and criteria of compulsory analysis and forecast of human health on industrial territories.

5. Justification, complex clinic, hygienic, geobiochemical, and cartographic description and isolation of anthropo-ecologically stressed foci and environmentally induced human pathologies. We are speaking about the scientific development of a fundamentally important provision, the essence of which is that the majority of industrial cities and agglomerations in Russia have turned into epicenters of permanent pollution, inside and around which stable (anthropogenic) foci of environmentally induced human pathologies have formed. Moreover, by the scale and, above all, dynamics of involving large human contingents and their progeny in the pathological process, the above-mentioned aspects of focal pathology are currently becoming perhaps more important than other relatively well developed concepts of geochemical provinces and natural focalization of certain diseases (Gichev, 1996).

6. We must stress that the very fact and unfavorable consequences of marked accumulation of toxic chemical compounds and heavy metals in the modern human organism's internal environment have not yet become the subject of serious conceptualization and discussion among clinicians. Meanwhile, the extent of physical and chemical pollution of the organism's internal environment has already reached values that can be treated as a real threat of violating the fundamental biological and biochemical basics of human vitality and physical existence. Based on these concepts, a topical objective of ecological medicine must be the scientific development and justification of a relatively new notion of hygiene and the protection of the cleanliness of the organism's internal environment as an aspect of practical endoecology and primary prevention. The study of this trend includes at least the following problems:

   - probing into the adaptive role and condition of the organism's main barrier systems, which function on the borderline between two environments (internal and external) and ensure the cleanliness and consistency of the internal environment;
   - the wide use of the state-of-the-art clinical and hygienic research methods of evaluation of the extent of pollution of the organism's internal environment by the most hazardous chemical compounds and heavy metals as an additional diagnostic and prognostic indicator and health index of the workers of unhealthy occupations and different population groups that live in ecologically unfavorable zones,
   - the study and evaluation of desintoxication and biotransformation functions of the liver and ways of their correction;
   - the study and evaluation of the main pharmakinetic parameters of the liver regarding the impact of unfavorable environmental factors in regions that differ in the nature and extent of pollution;
   - the development and approbation of new approaches to and methods of therapeutic correction and maintenance of the cleanliness of the organism's internal environment with the help of biologically active natural compounds of plant, animal, and mineral origin (Gichev, 1995–1999).

7. Development and justification of medical aspects and criteria to determine physical and moral damages to human health resulting from environmental distortions and environmentally induced pathological processes and the development of a system of socioecological compensatory regional coefficients depending on the duration of residence in environmentally unfavorable and hazardous cities and regions.

Moral and Ethical Aspects of Environmentally Induced Health Disorders

E. Fromm's profound idea, which he expressed a quarter of a century ago, that we should put an end to the situation when a healthy economy can exist only at the expense of the ill health of people, is unfortunately still applicable to the present situation in Russia: the current economic breakthrough is being made without taking into account unsolved environmental problems in the majority of the country's regions. Moreover, modern data about serious human health disorders because of the long-standing and large-scale pollution of vital environmental components are practically ignored. In fact, the main provisions of the sustainable development concept, once adopted and signed by more than 180 countries, have not yet become in Russia a guide for harmonizing further economic development with the protection and preservation of the environment and human health. Meanwhile, modern trends in the postindustrial development of civilized countries show that the economy based on the financial and industrial potential is being replaced by an economy based on the human and natural potentials. It follows that today the economic comprehension and forecast of the national health are gaining momentum (especially against the background of explicit signs of depopulation), returning to the spiritual and ethical values as opposed to increasingly prevailing technocratic thinking.

In other words, the prevalence of hazardous consequences of the environmental crisis, which has even aggravated due to the intended ways of economic growth disregarding the environmental component, is presently not only a scientific, technological, and organizational problem but also increasingly moral and ethical.

Indeed, it follows from Pope John Paul II's appeal (1989) in this connection that the environmental crisis is, in fact, a moral problem and many ethical values that play a fundamental role in the development of society are directly related to environmental problems. In recent years, many serious scientific publications have discussed this important issue and the increasing role of ethics and morals in resolving acute ecological problems (A.P. Nazaretyan, N.I. Moiseev et al.). On the assumption of the "law of evolutionary correlations," formulated by Nazaretyan (1991), we may conclude that the humanity's growing strength and environmental aggression should be compensated by improved morals; otherwise, society will fall victim to its might. We must stress here that morals serve today as a global antientropic factor.

The above largely echoes Moiseev's principle of coevolution of man and the biosphere, from which it follows that there can be no purely technological solutions to the problem of human survival under the current environmental conditions. The character and style of life, mentality, and immediate needs are to be changed for the sake of future generations.

However, considering the numerous materials and convincing scientific proofs of the existing environmentally induced damages to human health, we may come to a discouraging conclusion that the goals of the so-called scientific and technological revolution, allegedly aimed at optimizing the country's vitality, often yield the opposite effects with numerous manifestations of life destruction, a grievous consequence of which is the development of environmentally induced pathologies and a decrease in the longevity (populational progeria) of Russia's population.

This is why, morally and ethically, solving Russia's current dangerous environmental problems cannot be successful without the awareness that "... respect for life ..., for the dignity of the human personality (and we add, for health), is a fundamental rule on which healthy economic, industrial, and scientific progress should be based" (John Paul II). Moreover, as Dalai Lama XIV rightly stated in his Nobel speech in 1991, science and technology cannot replace the important spiritual and humanistic values that largely determined the development of world civilization.

In connection with this, during the implementation of the intended programs of economic growth and planned GDP increase, it is necessary to get rid of the century-long nature conquest imperative and realize its immorality (Petrov, 1998). Moreover, at present, it may be for the first time that the necessity for new morality in ecology is justified by strict natural-science argumentation and facts (Danilov-Danil'yan, 2001), many of which are summarized in the general publications over recent years and the team report of the International Commission on the Environment and Development «Our Common Future.»

Note the wise words of K.E. Tsiolkovskii, who back at the beginning of the 20th century wrote: "I do not accept technological progress if it surpasses ethical progress .... The humanity does not need just technology but moral progress and health."

On the Influence of Electromagnetic Fields on Human Health

The life of modern man and his further development are increasingly related to the use of different en-

ergy and information support. Radar systems, radio communications, and telecommunications are rapidly developing. We see the unprecedented growth of electric power production, and the level of its average per capita consumption has increased 10 times over the last 50 years. Ultra high-frequency electromagnetic waves are widely used in radio-relay communication lines, radio astronomy and navigation, radio spectroscopy, nuclear physics, various metallurgical industries, etc. New superhigh-voltage power transmission lines, comprehensive communications, and other industrial and household sources of electromagnetic fields (EMF) are commissioned far and wide. Moreover, electromagnetic impacts on the organism are widely used in medicine.

At the same time, among the main unhealthy ecological factors, electromagnetic fields as physical factors are the least investigated and discussed in the scientific medical literature. This is especially noticeable in the vast stream of scientific publications on the unhealthy impacts of chemical and radioactive industrial pollutants of the environment.

Meanwhile, the ever-increasing electromagnetic fields generation has resulted in the formation of an artificial electromagnetic background in the biosphere, which greatly differs by its properties and power from the natural background and represents relatively new and alien information for biological organisms. This phenomenon has been even characteristically branded the "electromagnetic smog." The notion of "electromagnetic ecology," first introduced into scientific literature in the early 1970s, is becoming more topical considering the latest data on the unfavorable electromagnetic fields impact on human health.

Note, however, that, although Russia has witnessed a sharp increase in magnetobiological research since 1960s, the overwhelming majority of works were devoted to electromagnetic fields impacts on plant and animal organisms, while these problems in relation to human organism have been studied to an incomparably lesser extent. Moreover, the unfavorable effect of the latter was mainly considered regarding hazardous professional impacts without analyzing their long-term consequences for the health of different groups of the population.

Since 1982, this problem has been fully reflected in the activities of the World Health Organization (WHO), which is the most authoritative international organization that deals with health protection.

In addition, a fundamentally important thesis concerning the problems under study was formulated to substantiate the 1996-2000 WHO program on electromagnetic fields biological impacts: it is assumed that medical consequences, such as cancer diseases, changes in behavior, loss of memory, Alzheimer and Parkinson diseases, the sudden infant death syndrome, the increased number of suicides, and some others, are the result of electromagnetic fields impacts.

Under such conditions, it is unjustifiable to ignore or underestimate numerous facts, accumulated by international scientific literature, that indicate a possible relation between the development of such serious diseases as leukemias and lymphomas, tumors of the brain and other organs (including in children), pregnancy pathologies, and inborn pathologies, disorders of the male genital function, various unfavorable effects on the nervous and cardiovascular systems and on visual organs, etc. and the lasting impact on the human organism of anthropogenic electromagnetic fields of industrial and household origin.

However, even now we find statements that it is not eligible to relate negative electromagnetic fields impacts to the development of the above pathological processes, since there is still no clear understanding of the mechanisms and points of application of this factor.

This negation of the evidential and consistent corpus of facts, accumulated in scientific literature, for the only reason of insufficient knowledge of the precise mechanism of the electromagnetic fields pathological action seems at least strange and recalls one notorious verdict of the French Academy of Sciences, issued in the 18th century, on the origin of meteorites, which said that "the so-called celestial stones cannot be such, because there are no stones in the sky."

In our opinion, the absence of full clarity in the electromagnetic fields -mechanism impact and, primarily, that of low frequency and intensity must generate even keener attention to information about the negative influence of the latter on human health and provoke deeper probes into this sphere in order to develop effective methods of protection and early prevention. This is also true of high-energy electromagnetic fields (ionizing and microwave radiation), whose deleterious action is now very successfully prevented in industry. From this stand, the action of low-frequency electromagnetic fields is still largely unpredictable, and, therefore, large contingents of the population remain unprotected.

In addition, the authors of many reviews on these problems doubt the existence of unhealthy electromagnetic fields impacts because excessive risk in the majority of cases is insignificant or statistically unreliable.

Here the main expert conclusions of the White House Committee on Science and Technology Policy are repeatedly cited saying that the analysis of papers published before 1992 found no convincing

proofs that very-low-frequency electromagnetic fields, generated by household electric appliances, video display terminals, and city transmission lines, can damage health. Moreover, these doubts are mainly because the size of electromagnetic fields impact risk is too low compared to other known hazardous environmental factors. However, it is necessary to make allowance for the sharply increased scale of spread and duration of the electromagnetic fields impact of different bands on large populational contingents, including children and pregnant women, in order to assess the unconditional prognostic value even of relatively low health risk indices.

In addition, it is also necessary to account for the fact that, in a number of cases, underdeveloped objective research methods may largely conceal the true risk of developing pathologies under the lasting electromagnetic fields impact.

Finally, we think it is not quite right to discuss the importance of excessive risks when we are speaking about such serious health disorders as stated above. This thought is very convincingly justified in the article by Harvard University Professors D. Kammen and R. Wilson, who stress that no one has the right to decide for other people which degree of risk is acceptable for them, and deserves serious attention.

Here we approach another very important social and ethical problem. As we see it, the only right policy in resolving threats and fears that arise in society is the population's full exposure to information on electromagnetic fields health impacts according to currently available scientific data. The more so that these fundamentally important and largely new materials are still not fully covered by both special domestic literature and popular periodicals.

That is, we are speaking about insufficient implementation and provision of the human right to access authentic and vital information on the state of the environment and the nature of electromagnetic fields impact on human health. As is known, this right is fixed in a number of international documents: the World Charter of Nature, the Bergen Statement, the Bangkok Declaration, the Brundtland Legal Principles, and the Universal Declaration of Human Rights. It is assumed, however, that timely public awareness of unfavorable environmental factors, the improvement of the level of environmental education and competence of the population, and the participation of the public in environmental examinations of different scales are important and necessary conditions of making ecologically sound and safe decisions when implementing different economic projects.

It is also noteworthy that the fulfillment of the above requirements, on the one hand, promotes the realization of the right to know, which is accepted abroad, and, on the other hand, timely information for people who are exposed to health risks gives them an opportunity to take timely measures of personal protection.

This provision proceeds from the practically important legal principle that communicating environmental risks is a strategy necessary to develop useful life and health behavior. In other words, the more accurately people are informed about environmental violations and their unhealthy consequences the better they can protect themselves.

The advisability of this approach becomes obvious if we take a number of developed countries (especially, the United States, Japan, and the Scandinavian countries) where the exposure of the population to electromagnetic fields health effects, beginning with the very first research projects into this area, has already triggered several legislative initiatives aimed to limit possible electromagnetic fields negative effects.

Thus, the Swedish parliament is already debating a ban on building schools and other daycare centers closer than 1000 m from transmission lines, and the United States annually spent more than $1 billion on measures limiting electromagnetic fields health effects back in the 1990s.

The decisions of the current public policy in this respect, based on the Report by the International Commission on the Environment and Development, can be formulated as follows: in cases when it is technically and economically feasible, electromagnetic fields low-frequency impacts on people must be minimized.

In other words, we should respect the unreserved right of people to decide for themselves on personal security, including legislative procedures, regardless of their initial motivations and concepts. The obligation of the scientific community is in timely and possibly the most unbiased communication of all vital problems concerning the effect of unfavorable environmental factors on health, including already available data on electromagnetic fields biological effects.

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TOWARDS A SUSTAINABLE RUSSIA

Bulletin "Towards a Sustainable Russia"
№ 35, 2006

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Published 500 copies

Supported by
The John D. and Catherine T. MacArthur Foundation,
The Charles Stewart Mott Foundation and Strana Zapovednaya National Foundation.
Distributed at no cost.

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(Reg. number 01777116)

ISSN 1726-4014