SECOND INTERNATIONAL CONGRESS

71 ECWATECH96 «WATER: ECOLOGY AND TECHNOLOGY»

ECWATECH-96

ABSTRACTS

MOSCOW, 17 - 21 SEPTEMBER 1996 ГОДА

SUPPORTED BY:

INTERNATIONAL WATER SUPPLY ASSOCIATION

TACIS PROGRAM EUROPEAN UNION

INTERNATIONAL CONGRESS

"WATER: ECOLOGY AND TECHNOLOGY"

ECWATECH

Moscow, September, 17 - 21, 1996

Edited by Prof. Leonid I. Elpiner

Отпечатано в АО «Красногорская типография»
143400, г. Красногорск, Коммунальный квартал, д. 2.
Заказ № 1759. Тираж 1000 экз.

ORGANIZERS

- Russian Federal Committee for Water Management
- Russian Federal Ministry of Construction
- Russian Federal Ministry of the Environment and Natural Resources Protection
- Russian Academy of Sciences
- Russian Association of Water Supply and Water Disposal
- Municipal enterprise "Mosvodokanal"
- State enterprise "Vodokanal St.Petersburg"
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Water: Ecology and Technology
International Congress and
Technical Exibition

much success,
wish all participants and visitors an interesting exchange
of information and a pleasant stay in Moscow.

Berliner Wasser Betriebe

PREFACE

The present publication contains abstracts of the papers that have been submitted to the Second International Congress "Water: Ecology and Technology"- ECWATECH-96 (Moscow, Russia, September 17-21, 1996).

For three years of its existence the main Water Forum of Russia ECWATECH-96 has acquired a number of specific features. On the one hand, the purpose of ECWATECH-96 is in a comprehensive consideration of different problems dealing with water use such as water resources, water supply, water disposal, legal and economic aspects of water use, etc. On the other hand, main emphasis will be focused on practical, specific technical, technological and administrative problems which trouble today managers, experts and administrators. Thus, the Congress reflects the comprehensive nature of the problems and the practical methods and mechanisms of their solution.

The Congress has focused the experts attention on the basic problems of the reliable water management activity in the modern economic and ecological conditions, it has given the recommendations for the choice of optimal administrative and economic approaches, has provided for the demonstration and selection of new engineering and technological solutions in water use and protection and has promoted the expansion of markets for water treatment equipment and services.

The representatives of all regions of the Russian Federation, Germany, Great Britain, Finland, Italy, Sweden, Switzerland, USA, the CIS and Baltic countries and other states contributed their share to the work of ECWATECH-96. The immense authority of the event is proved by the fact that the representatives of major international organisations such as European Union, World Bank and EBRD, International Finance Corporation, Water Supply and Sanitation Collaborative Council participated in the work of the Congress.

The papers in the publication are groupped according to sections and subsections of the Congress, namely:

- Water Resources (subsections: "Surface Water" and "Ground Water");
- Water Supply;
- Water Disposal;
- Monitoring of Water Resources;
- Economics and Law.

Within the chapters of the publication the papers are given in alphabetical order of the first author family name.

Some part of the papers that have been presented for the special events of ECWATECH-96,- vide licet round tables, symposia, seminars- is published separately. Taking all of this into consideration, all the abstracts that correspond to the economic topic are published in Economics and Law chapter.

The publication is issued in two variants - Russian and English. The English texts given by the authors, including the foreign authors, are remained in the original.

The editorship of Russian texts incorporating the translations of the English papers aimed at terminological and stylistic adjustments without any alterations in semantics. Several papers in which the generally known facts were omitted make an exception.

Editorial Board decided to publish some Russian abstracts without translation into English.

The publication does not contain the abstracts of the papers that were not adopted by the Scientific Commission because they do not corresponded to the topics of the Congress.

Unfortunately, not all the authors have submitted the abstracts in conformity with the terms fixed by the Organising Committee of the Congress. Owing to this fact the publication of such abstracts became impossible for technical reasons.

The publication is intended for the a wide circle of the sector professionals: managers, administrators, scientists, researchers, engineers, experts, etc.

Taking the opportunity and at the request of the Organising Committee the Editorial Board expresses deep gratitude to all Sponsors of the ECWATECH-96 whose financial support made the present publication possible.

SECTION I
WATER RESOURCES

SUBSECTION
SURFACE WATER

ECWATECH

ON ORGANIZATION OF ECOLOGICAL AUDITING SERVICE FOR LAND RECLAMATION SYSTEMS

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In Russia elaboration of documents on the ecological audit was foreseen by the Federal Program of scientific research "Ecological safety" in 1993-1995. But ecological audit is still not used for evaluation of ecological aspects of land reclamation systems management. The present study is the first step in this direction.

The measures that are taken to control the influence of the land reclamation projects on the environment, including ecological expertise, are not complete because they do not give a possibility to effectively evaluate the efiiency of nature protection during the system's exploitation.

Since design or putting into operation of new irrigational systems require significant investments, and therefore are now limited in Russia, it is at the same time obvious that no improvement of methods of analysis of ecological aspects of land reclamation by design of new and reconstruction of existing irrigational systems cannot ensure a real improvement of ecological situation. Ecological conditions of ameliorated and adjacent land depend just on the acting systems management. This fact determines the urgency of introducing a system of ecological audit of land reclamation systems.

Practical realization of ecological auditing of land reclamation systems requires creation of a special service. Organization of such a service is necessary for solving the two main problems.

First goal is to create the Regulations of ecological audit of land recla-mation systems which will determine the place of ecological audit in the whole system of control of influence of land reclamation projects on the ecological condition of environment. The Regulations must include sections determining the Rules and Programs of audit, informational support of audit service, requirements for the content and purpose of audit Conclusions.

The second goal is to elaborate the Law basis for the work of the service fulfilling both interior and external ecological auditing. The world experience shows that ecological auditing is, as a rule, fulfilled during short time (5-10 days) by non-state organizations uniting small groups of expert auditors. So it is neces-sary to elaborate the Regulations of licensing the work on ecological auditing of land reclamation systems. The Regulations must determine the equirements to the professional complement and qualification of ecological auditors group. Obviously such groups must include specialists in hydroeconomics of systems management, experts in water quality and agricultural production, hydrochemists, hydrologists and hydrogeologists, ecologists-ameliorators, specialists in the information analysis, economists and, maybe, sociologists.

The Law provision of rights of ecological auditors of land reclamation systems to obtain the necessary for audit information and spread auditors' Conclusions requires special elaboration.

The efficiency of creation of ecological auditorial service of land reclamation systems will be especially significant in current ecological, social and economical situation in Russia (worsening of the ecological situation, multistructuredness - appearance of numerous land owners in agriculture, i.e. actual decentralization of land and water usage).

Creation of this service will allow (by little state expenditures) not only to fulfill evaluation of nature-protection activity of the Board of land reclamation systems, but also to find the reserves and ways to improve the ecological conditions of ameliorated and adjacent land and the quality of agricultural production without additional investments - only at the expense of improvement of systems management and usage of new techniques of collectiing and processing of information for the analysis of systems work. The first positive result of introducing the procedure of obligatory ecological auditing will be the prohibition of action of land reclamation systems methods and means of which operation do not satisfy the ecological standards and restrictions.

SHIFTS IN THE IRRIGATION DEVELOPMENT IN ASIA

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Asia leads other continents in the development of irrigation. Irrigated lands in Asia comprise for 2/3 of the total irrigated area of the world with 0,042 hectares of irrigated land per capita. Agricultural development of many countries totally depends on irrigation facilities. Irrigated lands account for more than 60% in Pakistan, North Korea, Japan and more than 40% in China, Iraq and Israel. Irrigated lands provide almost 2/3 of total agricultural output and support huge population of Asia with vegetable food (in 1995 population of Asia estimated 3,4 billion, in 2025 it is expected to increase as 5 billion people). Thus the future trends of irrigation development are of vital importance for solving food problem in densely populated region.

The possibility of growth of arable lands under irrigation is limited by a number of factors. Many river basins are facing deficit of water resources and particularly river flow. Agriculture is the main sector of withdrawal of water in Asia (for example, in China the annual withdrawal of water for agricultural is 87%, in India - 93%). Norms of watering of agricultural crops in Asia are higher than in the other regions (in India and Turkmenia they account for 9000-10000 cubic meters per hectare, rice growing demands more than 30000 cubic meters of water per hectare, in Europe norm of watering does not exceed 4000 cubic meters). The efficiency of many irrigation systems is poor, only the advanced systems utilize 50-55% of water for irrigation purposes. The increase of efficiency of existing irrigation systems to the level of advanced systems could save in a country like China 100 cubic km of water that is 25% of annual water withdrawal for the needs of irrigation.

Deterioration of irrigated lands is the other serious problem of agricultural practice in many countries of Asia. Taking into consideration huge area of irrigated agriculture in Asia the extent of land degradation processes is enormous. Positive and negative aspects of irrigation projects are widely discussed in scientific papers. Some of them publish articles under quite typical titles as "Irrigating good land to death"(Panoscope, 1994). As a result of fertility losses, waterlogging, salinization and alkalization of irrigated lands the level of grain production under irrigation is less than it was expected.

Perspectives of irrigation in Asia are connected with changes in the systems and methods of irrigation and new crop varieties. There are new methods of irrigation allowing to reduce water consumption and to mitigate degradation of environment. In Israel as a result of introduction of new irrigation practice 3 crops are harvested annually under irrigation norm of 5,7 cubic m per ha. Rice growing technology without pesticides decreases water consumption by 25%.

On the base of the analysis of irrigation practice in Asia for the last decades it is getting evident that the practice of extensive growth of lands under irrigation (in many countries there are no possibilities to increase irrigated areas) is superseded by intensive management of the existing irrigation systems, land melioration, introduction of modern methods of irrigation and cropping pattern. In some countries of Asia with high level of economic development advanced irrigation systems are widely used. As a result the productivity of irrigated lands in desert zones increased to 65-68 centers per hectare. Detailed schedules and regimes of irrigation are being developed and many irrigation systems are managed automatically.

OPPORTUNITIES OF REALISATION OF SMALL HYDRO PLANTS CASCADES ON LOWLAND RIVERS MAINLY WITHOUT CONSTANT FLOOD-LANDS SUBMERGENCE

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Because of strained situation in power engineering of Republic of Belarus and deteriorated ecological conditions a present-day tasks for the country are refurbishment of neglected small hydro plants and development of hydropower.

For Belarus the greatest power value are rivers of West Dvina and Nieman basins, whereas this part of the country less others are polluted by full-out radioactive materials Therefore withdrawal of land here from traditional (agricultural) use for possibility of reservoirs placing on it and construction of usual hydro plants is problematical even with highly favourable topographical conditions of river valley.

Given paper is dedicated to basing of ecological, technological, technical and economic efficiency of construction of small hydro plants cascades of lowland rivers (in Republic of Belarus) mainly without constant flood-lands submergence. It is achievable by means of realisation new way for waterpower use (patent of Russian Federation N2039189 on invention). According to this way regulating reservoirs, formed in river bed without going out of backup water levels from its banks are hydraulicly connected in united multi-step reservoir of hydropower cascade. It is assured by means of hydraulic automatic equipment use for stabilisation of head acting on cascade water works and as a result realised possibility of daily (weekly) river runoff regulation without constant flood-lands submergence. Besides it takes place with essential decrease of amplitude of backup water levels fluctuation, that improves river ecology and ground water level regime of adjoining territory.

The paper includes revealing favourable (by topographical and hydropower conditions) river sections: with considerable fall along the current, natural river flow regulation and sufficient exceeding of bed banks over low-water level. Suchlike natural conditions has a riverhead of the Dnieper for a distance of 88 km from the boundary with Russia to settlement Copis (that between Orsha and Shklov) and some rivers of West Dvina and Niemen basins.

On mentioned section of the Dnieper river fall make 11 m, bed banks rise above low-water level to 5 m and more. Therefore it is possible to realise here three-stepped or four-stepped cascade of small hydro plants of described type with total installed capacity about 5MW. Besides it is assured here radical improvement of meadows in river valley, where those degenerated owing to low standing of water in river and groundwater level of flood-lands. Amplitude of backup water levels fluctuation in steps of this cascade in the time of daily river runoff regulation can not exceed 0,15 m.

Acceptable sections for realisation of suchlike cascades are revealed on rivers of West Dvina basin: Loochesa, Obol, Ushacha and others. It is possible to construct the cascade of low-head hydro plants on the Niemen (in the vicinity of Grodno), enveloping by its upper steps tributaries Cotra and Svisloch, with total installed capacity about 27 MW and also cascades on tributaries of the Niemen: Vilia, Dvinosa, Stracha, Naroch, Oshmianka, Isloch and Issa.

Basing of chosen versions of considered cascades partially is financed by Byelorussian Fund of Soros (according to contract of the 5th September 1995).

THE STATE OF LOCAL RIVERS BY VOLGA IN THE REGION OF ASTRAKHAN GAS COMPLEX

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Astrakhan gas processing complex is situated on the left bank of the Volga, about 60 km from Astrakhan. Since 1985 it is functioning as a technogenic territory, most important part of it is situated dear the Volgo-Achtuba area. the main local rivers around Astrakhan gas processing complex, are Busan, Kigach, Achtuba, Bereket.

In the base of creation of the technogenic system are gas pollution delivered to environment, (about 80 thousands tons by year), pollution waters and sewers.

For the estimation of the state of the local rivers was organized constant ecological monitoring. Hydrochemical and hydrobiological analysis of nature waters make in accepted methods. the sampling of water was according with the main hydrological phases.

The season changeable of macro (Ca^{2+}, SO_4^{2-}, Cl^-, HCO_3^-) and microcomponents (Fe, Cu, Zn, Pb, Co, Cr, Ni, Cd, Mn), combinations of nitrogen, gas regime, (O_2, CO_2), pH and maintenance of oil products was analyzed.

The staff of phyto- and zooplankton was the same as all local rivers of Volgo-Achtuba area.

Saprobility index was 1,53-2,32 (1,46-2,07 in stagnant waters). It shows moderate pollution of local rivers.

The results of our work allows make conclusion: the main pollution of local rivers take place now at the expanse of transit sewers.

THE MICROHOTBEDS DESERTIFICATION IN THE IRRIGATIONAL ZONE OF THE MIDDLE AMUDARYA (CENTRAL ASIA, TURKMENISTAN)

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The irrigational desertification always follows the land irrigation if arid zones. The soil salinization and deep ecosystems degradation are its usual result. The degradational processes are accompanied by the rebuilding of ecosystem's structure, formation of ecotonal structures, disturbance of ecosystems sustainability and lowering of biodiversity.

The microhotbed desertification is one of the most widespread forms of irrigational desertification that is quickly developing in the massives of irrigational lands as well as its marginal zones. The total area of these hotbeds i the irrigated regions of the middle flow of Amudarya is comparatively small, but their ecological role is significant: microhotbeds of desertification serve as "conductors" of ruderal species and halophytes into the meadows and appear to be reserves of adventive species of plants and animals able to expance, that change the characteristics of biotic cover of the whole region.

Peculiarities of relief, especially depressions in areas of technogenic influences and anthropogenic changes of hydrological conditions, halochemical and lithoedaphycal situation promote to forming of microhotbeds irrigational desertification.

Depressions of the land surface that occupy 0,25-1,0-1,3 ha on crossways of irrigational channels and spoiled water collectors in Kerki, Halach and Karabekaul regions (left band of Amudarya) that are used for irrigated cotton plantations can serve as an example of microhotbeds formations. At that areas the depth of ground water table varies from 28 cm to 40 cm and salts are moving to the direction of the surface where salinized soils are forming.

In vegetation cover the microcountour groups are forming, including Aeluropus littoralis, Tamarix hispida, Suaeda altyissima, Salsola paulseni, Climacoptera lanata. Halophytes are dominating in some places: Alhagi persarum, Karelinia caspica, Glychiriza glabra, forming the density of sward of 17-20%.

Zoocomplexes in such hotbed of desertification include Coleoptera et Mimenoptera which are connected with ruderal species of plant, spiders and such vertebrates as Crecetulus migratorius, Mus musculus, Alactaga elater, Meriones meridianus and Rhombomus opimus, Their colonies concentrate on the borders of the hotbeds, mostly on technogenic terricons near channels and collectors where zoogenic vegetation is forming.

ENVIRONMENTAL AND WATER RESOURCES MANAGEMENT IN THE UPPER VOLGA BASIN

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The implementation of the Subcomponent "Upper Volga basin integrated regional environmental and water resources management polices and strategies" is carrying out in 3 steps.

During the first step (Preliminary Phase), detailed description of the Upper Volga ecosystem condition has been done, including spatial-temporary changeability of surface waters and ground waters quality, catchments condition, character of industrial and agricultural production, main sources of pollution, demographical and social-economical indexes, public health. Precise analysis of different aspects of the existing system of water quality and water resources management has been done: administrative, normative-legal, economical, social, technical, etc. As a result the main regional problems are determined:

- cumbrousness and low efficiency of environmental and water resources management system (including water quality and water resources);
- low drinking water quality, and, as a result, unsatisfactory public health condition;
- considerable role of industrial enterprises in the deterioration of surface waters quality (detailed assessment of non pointed sources impact is absent);
- absence of the regional system of compilation, processing, analysis, storage and dissemination of information, useful for administrative resolutions adoption in the sphere of environmental protection.

In this connection on the base of the general concept of the Component "Water quality and water resources management", recommendations of Russian and foreign specialist, consultants with representatives of administrations, ecological-resources agencies, the following main objectives and tasks of the Subcomponent implementation have been formulated:

Objectives:

Determination of strategic ways and programs of priority investments for the improvement of quality and efficiency of water supply systems in the selected cities, assessment of alternative directions of regional economical policy for water use and water quality management, and development of administrative reform programs for industrial and municipal water supply.

Tasks:

Task 1. Develop screen alternative integrated regional water quality and water resources management system, including investment strategies, and institutional investments and reforms.

Task 2. Assess regional drinking water system and identify the ways of its improvement.

Task 3. Analyze waste water system management and determine the ways of its improvement.

Task 4. Develop an analytical description of the regional ecological system, develop prototype of the regional common informational system of water quality and water resources management system.

On the base of the selected priorities, objectives and tasks at the second phase (Inception Phase), concept of the Subcomponent implementation has been developed, based on the basin principle of water quality and water resources management. The following tasks have been done:

- formulation of the main priorities of all the tasks;
- selection of demonstrational systems of drinking water supply and industrial enterprises - waste waters sources;
- selection of the basin informational-analytical centre;
- determination of work steps, their objectives, duration, anticipated outputs, system of control on their execution;
- assessment of the resources necessary for each of the tasks implementation, including the number of specialists, necessary equipment and finances;
- determination of problems influencing on the Subcomponent implementation;
- development of the Subcomponent implementation plan and schedule.

Successful implementation of tasks and achievement of the Subcomponent objectives is impossible without coordination of actions in frames of the Component, EMP in RF and other programs being implemented in the Upper Volga region. In this connection correspondent programs and plans on works coordination on the Subcomponent implementation with the Ural and Northern-Caucasus Subcomponents, Subcomponents "Ecological policy and regulation", with federal programs "The Volga revival", "Water quality norms and standards". Besides, programs of the Subcomponent implementation results dissemination and connections with public organizations have been developed.

At present time the third Phase (Implementation Phase) is beginning. During this Phase it is planned to achieve the following results:

Outcomes:

1. Organization and demonstration of the effectiveness of the regional water quality and water resources management system (water bodies and sources of pollution monitoring, informational systems, delivery of permissions for water use and control of their maintenance, water quality norms and standards, analytical centre of resolution adoption support etc.).
2. Forming of the regional programs of minimizing of pollutants influence on the Upper Volga water bodies and mechanisms of their implementation.
3. Regional program of drinking water supply improvement in the Upper Volga basin and mechanisms of its implementation.

IRRIGATING WATER: PROBLEMS OF QUALITY AND ITS IMPROVEMENT, WORKING OUT OF STANDARDS UNDER MARKET CONDITIONS

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Ecological situation formed in the Ukraine under conditions of land use transformation, meds of an accelerated ways for working out of ecological norms for permissible anthropogenic loads on ecosystems. Working out of standards, ecological safety norms for state service of soil monitoring and soil protection is the most real way to solve this problem. It is known that quality of irrigating water affects on direction of soil processes and soil evolution. Very often bad quality of irrigating water leands to soil degradation processes, such as: salinization, alkalization, solonetrization and so on.

Under conditions of land reform when land and water are paid, correction factor on irrigating water quality must be introduces into practice.

State Ukrainian Standard 2730-94 "Quality of natural water for irrigation. Agronomical Criteria" has been worked out. Estimation of water in the view of salinization, solonetrization, alkalization dangers and toxic influence on plants have been included in this State Standard. Estimation of water on the basis of analytical concentration of ions in the water and thermodynamic indices (active ions concentration) has been carried out for few groups of soil with different buffering to degradation. Two classes of water have been determinated; 1 class - "suitable" and 2 class - "partly suitable" for irrigation. The waters of first class can be used without any limits, waters of second class can be used only under conditions of water quality control and special agromeliorative efforts for decreasing of negative phenomena in the soils.

The main methodical approach to estimation of natural waters quality is experimental - expert estimation in the system "water (irrigating) - soil - plant". This working out have been included into plan of preparing of inter state standards.

Induces of water quality according to ecological criteria include: content of macro elements of plant nutrients (nitrogen, phosphorus), micro elements (manganese, iron, copper, boron, fluorine, cobalt, zinc, molybdenum), heavy metals (lead, mercury, cadmium, chromium, aluminum, nickel, etc.), pesticides and other contaminations (Bezdnina S.Y., 1994).

Microelements and heavy metals content have been limited on the basis of fitotoxic, translocation, water-migration, sanitary-toxic indices. General estimation of water must be realized on the basses of total contamination in accordance with gradation we have developed.

Normative document "Ecological criteria for estimation ofirrigating waters quality in the Ukraine" have been prepared.

Together with Standard № 2730-94 they form the basis for start up of normative documents bank.

Improving of qualitative composition of irrigating waters have been achieved through the treatment of water by calcium meliorants: gypsum; chock, decomposed by sulfuric acid; calcium nitrate and other meliorants.

INFLUENCE OF THE CASPIAN WATER-LEVEL RISE ON ECOLOGICAL SITUATION OF COASTS

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Water-level rise of the Caspian sea, that began in 1978 year caused to life significant rebuilding of natural complexes in its coastal zone, changes in landscapes and ecological situation on the coasts, that gave impulse to activisation of scientific studies of all problems in this natural region.

The studies water carried out in 1993-1995 years on Dagestan coast of the Caspian sea. We distinguished the three zones according to the level of influence of the sea waters on the landscape complexes: zone of the direct sia impact, zone of indirect impact and zone that is not influenced by the sea waters.

In the first zone the transgressing sea cause the shift of vegetative belts up along the profile and their shrinking, changes in plants density and bogging of some patches. This zone is clearly distinguished on the territory of terraced Dagestan (Turali), in the region of exposure of ground (pike Satun to the south of City Kaspiysk). In the zone of indirect sea influence there are changes in ground water level and halo-geochemical soil composition. In this zone the empoverishment of species composition of vegetative communities and replacement of xerophyle species by mesophyle take place. In some places the zone of indirect influence may be absent, for example on the patches with city constructions. The territory, where the sea influence is not visually observed, we called the zone without sea impact. The reare no changes in species composition of plants, but there are lowering of plants density and lowering of some species abundance, though less

than in previous zone. Boundaries between ecotones may be very distinct.

On the coasts with anthropogenic activity the territories flooding by sea waters is more. On the patches with city buildings of Mahachkala, Kaspiysk and especially Derbent the sea advance goes with catastrophic consequences.

OPTIMIZATION OF RECLAMATION REGIMES OF TECHNOGENIC-LOADED TERRITORIES IN THE BALKHASH LAKE BASIN

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Irrigated agriculture has become a general reason of change of water resources state of the Balkhash lake basin. Correlations of expense components of water and salt balances of surface and groundwaters have changed, salt structure of river water, where collector-drenage waters (CDW) of reclamation system flow down in, has broken. From 25-28 km^3 of renewed annual resources of surface waters of the basin only 6-7 km^3 are used for water provision of reclamation system with total area 700 thousand ga. Rice fields, totaling only 35 thousand ga, annually take up to 1,7-2,0 km^3 of river water.

Irrigation lands of rice fields are the most technogenic-loaded areas and caused ecological stabilityless in the state of nature waters not only of adjoining territories but the whole basin. In accordance with the results of long theoretical and natural investigations we substantiated a structure and level of reclamation loads on the territory of the Balkhash lake basin and methods of calculation of optimal reclamation regime. The principal indicators, describing a reclamation regime corresponded to the following criteria: a) water volume, necessary to water user is regulated by the state or private order connected with production and sale of agricultural yield; b) water for should use the given water volume on conditions of preservation of high level of the reclamation state of irrigation areas and soil fertility - to secure the optimal limits of regulating of ground water level on irrigated and adjoined territories, decrease a content of damagely salts in soil solution, increase a content of humus, nutritives and ect,; c) water diversion from reclamation system shouldn't cause a treat of pollution of natural waters. Earlier in water economic practice a reclamation regime of irrigated territory was substantiated at first, then parameters of water-bearing and waste system were calculated. We propose an opposite approach for determination of parameters of regime. First it should be substantiate an optimal technogenic (reclamation) loads on water resources (to determine rational volume of throwly of collector-drainage waters and limitly admissible rates of throwly of polluting substances. Knowing volumes of water diversion to calculate modules of drainage flow, intensity of infiltration supplying of ground water and than, taking into consideration concrete technical-economic possibility of waterbusers to determine necessary area of irrigated lands.

This approach for the first time was introduced into practice of water use at Akdala and Karatal rise system that has allowed to exclude unprofitable and ecological-unfortunate irrigated lands from agricultural cycle of operations; to improve reclamation state of irrigated massifs; to decrease the level of pollution of water receivers (Ili and Karatal) of collector-drainage waters and exclude pollution of ground water of adjoined territories.

INTERNATIONAL PROJECT "OKA-ELBE": RESULTS AND PROSPECTS OF TECHNOLOGICAL COOPERATION OF RUSSIA AND GERMANY IN THE FIELD OF RESEARCH WATERCOURSE AND SAFE-ECOLOGY TECHNOLOGIES

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The work on the international project "Oka-Elbe" was begun 1992 by helping of research organizations on the basis of the national projects "Oka - clean river" and "Elbe 2000" pursuant to the Agreement between Ministry of research and technical policy of Russian Federation (Minnauki Russia) and Federal Ministry of researches and technologies FRG (BMFT).

The purpose of the specified projects is system engineering of measures and means for decrease of antropogenic load in basins of Oka and Elbe rivers by study of the reasons of pollution of river waters and sediments, realization of a complex organizational, legal, technological, economic and social projects and programs, as well as introduction of progressive methods and means of clearing waste waters, firm waste and gas.

Organizational and research activity within the framework of the project "Oka-Elbe" execute: from the Russian party - Minnauki Russia, administration of Vladimir, Moscow and N.Novgorod regions, All-Russian research institute of hidrotehnic and lend reclamation (coordinator), N.Novgorod architect-building academy, Institute biology of internal waters. Institute of problems of the market, Russian scientific center "Applied chemistry", Oka ecological fund and other. From the German party - BMFT, Center of nuclear researches Karlsrue (coordinator), Research center GKSSD, Institute of a water facilities in Magdeburg, Lend department Northern Rein-Vestfaly, Heidelberg university, University Karlsrue, Hamburg university.

One of main measures within the framework of the project "Oka-Elbe" is realization of joint forwarding and labor-analytical work. Researches executed on uniform technique, have allowed, in particular, to establish, that basin of r.Oka is less polluted by heavy metals, than basin r.Elbe. Exception is a high level of pollution of sediment by cadmium in r.Klyzma, as well as sites r.Oka and r.Moscow, that is alarm bell, since cadmium concerns to tocsicants with sharply expressed ability to cumulation. In basin of r.Oka the most polluted sites are: r.Oka below cities Orel, Ryzan and Murom, as well as below mouth of rivers Upa, Nara, Moscow and Klyzma; r.Upa below Tula; r.Nara below Narofominsk; r.Pahra below Podolsk; r.Moscow from Moscow city to a place near mouth; r.Gus below Gus-Hrustalny; down stream of r.Klyzma.

Within the framework of the project "Oka-Elbe", as well as in the base national projects "Oka - clean river" and "Elbe 2000", at creation of new processes of clearing of a water, vehicles and installations for their realization the advantage is given up to reagentless, safe-energy and combined processes, as a result of which minimum quantity of concentrated polluting substances, requiring reservation, salvaging, detocsication or repeated clearing will be formed.

The first results of the international project "Oka-Elbe" were submitted by the developers in the joint report to governments of Russia and Germany and have received high valuation as a example of the constructive approach to the decision of ecological problems.

It is supposed, that in 5 years after beginnings of fulfillment of technological work introduction of new systems and technologies of clearing of a water at the enterprises, located on the most polluted sites and regions, and will be supplied in 10-12 years - complete replacement of conventional systems on in essence new, appropriate to world level is made. Bank of data will allow to the enterprises and municipal bodies to receive and operatively to use the necessary information for acceptance of the optimum decisions on particular technological problems.

The successful realization of the technological projects is possible only in a complex with economic and legal measures, which should be based on a system tax, financial and credit levers, ecological specifications, measures on formation of the special market of the quotas on pollution, ecological insurance and other making managements of water facilities, adequate conditions of transition to the market relations.

The results of fulfillment of the project "Oka-Elbe" introduce the real contribution to the decision of ecological problems of Russia and Germany, to development of technological cooperation between two countries.

COASTAL CONTAMINATION OF FRESH WATER AQUIFERS IN THE SOUTHEASTERN TRACTS OF KUTCH REGION (GUJARAT)

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The coastal area of Kutch has been facing the problem of groundwater contamination. In the present study, a part of coastal area of Kutch between Gandhidham and Mandvi towns has been taken up (about 120 km in length and 10 to 15 km in width). Geologically Deccan trap (basalts) of Cretaceous - Eocene age forms the basement for the shale, siltstone - claystone and conglomerates of Pliocene and for Miliolite Limestone and Recent age formations, respectively. Earlier hydrogeomorphological studies have indicated very limited availability of good quality of water.

The study has been carried out covering three seasons viz. premonsoon, 1992, postmonsoon, 1992 and premonsoon, 1993. The groundwater samples collected have been analysed using geophysical and geochemical methods (for example TDS, Cloride-Bicarbonate ratio, Chloride ratio, Magnesium to Calcium versus Chloride relationship, a straight line relationship of Chloride with other ions, Iodide & Chloride relationship etc.). The results have indicated occurrence of contaminated groundwaters up to a depth of about 20 to 30 m and at a distance of 1 to 2 km from the coast in Mundra taluka. Also in Mandvi taluka similar results have been obtained albeit, at deeper levels (40-80 m). In general, it has been observed that in premonsoon, 1992 highly concentrated groundwaters, characterised by NaCl

type have been obtained owing to prolonged dry spells in the past. However, postmonsoon, 1992 analysis has shown somewhat diluted waters of NaHNO3 type which is caused due to above normal precipitation in that season. The waters of premonsoon, 1993 has reflected almost similar type of chemical composition to that of postmonsoon, 1992, nevertheless, a small fraction of samples did indicate enrichment of groundwater with NaCl. Several rehabilitation structures installed/constructed in the region have shown improvement in the quality of groundwaters locally.

Three type of salinities of the groundwaters have been deciphered and accordingly different zones have been demarcated namely, inherent salinity, coastal salinity and salinity due to sea water ingress. It is concluded from the study that the groundwaters of the coastal belt of Kutch region were fresh groundwaters not in the distant past but were later affected by saline conditions viz., evaporation, mixing, dissolution etc. In some areas however, old saline/brackish groundwaters are present. The deterioration in the quality is largely due to the evaporation of the groundwater, though the role of sea water encroachment into acquifers is also of local importance. The salinity of groundwater is also not related to the present day/modern sea water but can be correlated to connate waters which occur as isolated brine at a few places.

THE ESTIMATION OF THE EFFECT OF SOME XENOBIOTICS ON THE FORMATION OF BEHAVIORAL REACTIONS OF STURGEON FRY

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The task of preservation and replenishment of the spawning part of sturgeon population requires a greater attention to early stages of their ontogenesis. Particularly important is the behavioral aspect of the problem, especially, homing which includes both inborn components and those imparted to fishes by man long before the beginning of maturity.

In tests on sturgeon specimens it has been shown that the formation of imprinting is observed at the "critical" stage of development of prelarvae when they switch over to exogenous feeding. The formation of imprinting is disturbed by the presence of such toxic agents as lindan (0.1 and 0.5 mg/l) and oil (5 mg/l). It has been observed that the action of these substances is particularly harmful in the "critical" period of the development of specimens and becomes less so in two-week old larvae.

In accordance with the available published data on the importance of thyroid hormones for the formation of olfactory memory in certain fish species, an investigation has been made concerning the level of these hormones in tissues of sturgeon at early stages of their development (from hatching to the end of the transition to exogenous feeding). It has been shown that the sturgeon specimens which experienced a toxic effect exhibited not only memory disorder but also changes in the level of thyroid hormones which resulted in the lowering of dynamics (as compared with the norm) of the production of thyroxin, the conversion of thyroxin into triiodthyroxin, and of the inclusion of triiod-thyroxin into metabolic mechanisms.

It is assumed that the short-term impact of toxicants at early stages of the development may adversely affect the behavior of matured fish.

THE INFLUENCE OF DISPERSED SOURCES OF POLLUTION ON THE STATE OF WATER RESOURCES

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The problems, connected with estimation of the influence of dispersed sources of pollution upon ecological state of water bodies, became very acute nowadays.

Formation of the main flows of polluted elements, which influence considerably on the quality of surface waters, takes place at the water-catch areas of small rivers.

In order to estimate the influence of the water-catch areas, structures upon the formation of hydrologic and hydrochemical regimes of small rivers and working out the water-protection measures in 1993-1995, there was held a complex of water-protection measures in the basin of Aramilka river, which is a right-bank tributary of Iset river.

The investigated water-catch area is characterized by different degree of economic use. The upper

reaches of the basin are represented mainly by the natural lands, the part of which is included into agricultural turnover, but are not subjected to plough up. Down stream the river decreasing of anthropogenic load takes place, this decreasing depend on the influence of hydrotechnical melioration and also on the income of the pollutions from inhabited territories and cattle-breeding complexes.

The formation of the chemical ingredients of the surface water flow in the period of spring floods takes place as a result of interaction of melted waters with the substances, which are placed in the upper layer of the arable land. Because of it, mineralization of the slope waters is increased several times in comparison with the snow waters. Slope waters are characterized also by high concentration of biological and chemical substances, of nitrate and ammonia nitrogen, of some suspended substances, phosphorus and potassium.

Comparison of the chemical ingredients of the surface flow with drain waters shows that by formation of the intra-soil flow, the concentration of some nutrient elements (phosphorus, potassium) and of suspended substances decreases considerably. The main polluted substances, coming in Aramilka river with drain waters, are ammonium nitrogen and trivalent iron.

Maximum concentrations of nitrogen, phosphorus, potassium and suspended substances in the river waters appear in the period of spring floods, which depend on the activation of erosion processes and increasing of the intra-soil migration. In summer, after heavy showers, the increase of the concentrations of nutrient elements and suspended substances in the river waters also takes place, notwithstanding the increase of their disposal. In the number of cases the concentration of ammonium nitrogen was very high.

Generally, in the period from April to October nearly 6,5 kg/ha of mineral nitrogen and nearly 0,2 kg/ha of phosphorus and 4,6 kg/ha of potassium come into the river waters. The main part of nutrient and suspended substances come into the water flow in the period of spring floods, when together with the melted waters more than 60 % of the year discharge of nitrogen, phosphorus and potassium are brought into the river from agricultural water-catch areas.

From the river head, down the stream , there takes place the increase of the general index of nutrient substances income , which depends on the increase of the degree of anthropogenic load on the water-catch area. This fact takes place mainly during the period of spring and summer rain floods, as a result of increasing the flow from dispersed sources. The investigations showed that the discharge of nutrient elements from agricultural water-catch areas is more than 2 times higher in comparison with non-ploughed water-catch area, represented by forest and meadow. Considerable role in decreasing of nutrient load belongs to such compensative parts of landscapes as tree-shrub lines, which decrease in 1,4 times the income of nutrient substances into the water-flow .

As a result of systematic investigations there was made ecology-water-management estimation of the Aramilka basin and a complex of water-protective and water management measures was suggested.

HYDROECOLOGICAL GROUNDS FOR OBJECT SITING ON THE URBANIZING TERRITORIES

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Nowadays the most attractive areas for construction are the unused territories of different sanitary-protective zones - intake sanitary conservation zones of streams and reservoirs, green zones. It is planned to site here shopping centres, cottage districts and the city infrastructure objects ecologically dangerous for surface and ground waters: service stations, garages, parking lots, oil storage tanks and warehouses.

In order to assess the possibility of siting these object the ecological and especially the hydroecological basing should be measures on the preliminary stage of projecting.Elements of nature complexes, connected with the hydrosphere and their natural and present transformed condition are studied. The microclimatic, geomorfological, hydrological, geological, hydrogeological, migrational, soil-botanic, lithochemical and landscape-ecological peculiarities of the territory are defined, the geopathogenic zones are identified.

Technogenic load on the nature complex is assessed which is being connected with present and prospective use of the city territory.

The intial data for work are on location researches of the object territory, fund and literary materials, results of already fulfilled work, etc. The main sources of technogenic impact and contamination are identified. A series of specialized assessing natural, inventory-technogenic, inventory-resourceful, town-building and synthetic ecological maps based on the GIS-technology is created on the results of the researches. The maps give the ground for zone estavlishment according to building possibilities of the territory. The favourable are defined, and the water conservation measure complex is worked out which includes:

- organization and diversion on surface runoff;
- leakage prevention from water supply communication;
- drainage system building;
- modern amenities and greenary planting;
- engineering-technical actions for elimination of surface and ground water, soil/rock contamination sources;
- creationof sygnal regime monitoring network.

Work of this kind was fulfied by the CRICDWR together with SPF "ECOFOR", ICEE "Belarusecology"

on some object in Minsk and Gomel. Different specialists took part in this work: geologists, hydrogeologists, geomorphologists, geochemists, hydrologists, botanists, ecologists, architects, specialists in water supply and in water resource use and conservation, specialists in landscaping and soils.

SCIENTIFIC BASIS AND DEFINITION OF WATER CONVERSATION ZONES STRIPS OF STREAMS AND RESERVOIRS ON THE CITY TERRITORY

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Water conversation zones and water object riparian strips are very effective preventive measures from water resource contamination, choking up and exhaustion.

Border establishment of the stream and reservoir riparian strips and water conversation zones has some specific methodical features and should be carried out on the ground of special researches.

The water conversation zone within the city limits is the territory adjacent to the stream and reservoir water area, where a special regime of water and land use is established, combined with the system of territorial-planning and engineeringtechnological water conversation measures for prevention of water contamination, choking up and exhaustion and of natural ecosystem violation.

A riparian strip is alloted within the water conversation zone in which economic activities are strictly limited.

The width of water conversation zone is defined by the complex of special researches based on analyses and assessment of natural conditions and anthropogenic load, taking into account the morphometric surfaces of river system valley complexes, hydrogeological characteristics and hidrochemical regime of surface waters, geological structure and hydrogeological conditions of the territories, soil erosion resistance, water conservation efficiency of greenary, hydrotechnical objects impact on the stream and reservoir water regime, the level of the city landscape protection and also the conditions of the town-planning and building.

Water conservation zones includes as a rule a flood plain, a part of the river valley, streep bank slopes and big gorges, gullies and ravines, closely connected with the river valley, and also the second belt of sanitary conservation zone of water supply sources.

Object built on the water conservation zone territory before their adoption, should be subjected to ecological audit for determining their possibility for functional use within the limits of the water conservation zones.

The problem for today in the Republic of Belarus is the establishment of water conservation zones in all big cities and industrial centers.

The CRICDWR together with SPF " ECOFOR" and ICEE "Belarusecology" has been carrying out researches on water object conservation zone border grounds in Minsk, Pinsk, Borisov, Slutsk, Molodechno, Gomel and some other towns in the Gomel district since 1993 to present. They created the informational system " The digital map of the Minsk water conservation zones" and are working out now the geoinformational system based on the programme complex and visualization of the digital Minsk topographical map analogue with the 1: 15000 or 1: 10000 scale.

RUSSIAN-AMERICAN ENVIRONMENTAL SCEINCE EDUCATION AND TRAINING PARTNERSHIP FOR STUDING OF THE ANGARA RIVER WATERSHED

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The RESET Partnership (Russian-American Environmental Science Educational and Training) was adopted by the Russian and American partners in January 1995 to tackle the real-world environmental-economic-health-policy problems existing in the Angara watershed. This program is mainly focused on training students in the field of environmental management as well as carrying out joint scientific research. This program gained support from the Environmental Protection Committee of Irkutsk Oblast and the State Committee of Higher Education of Russia, as well as NASA Space Grant Consortium, Freeman Charitable Trust and Dr. William Murray from the American side. Support has been also requested from various national and international foundations and organizations.

The focus of the RESET is the heavily industrialized and environmentally impacted Angara River

watershed. This watershed forms an environmental continuum or gradient from the near pure fresh water which emanates from Lake Baikal, the world's largest, deepest and oldest lake, through the Irkutsk hydroelectric dam and the increasing effects of air and water pollution due to one of the world's largest concentrations of aluminum processing, petrochemical industry, coal mining, lumber and paper processing, etc., and ending in the Bratsk reservoir. These environmental challenges are especially acute in Siberia where the economic pressure to exploit regional resources is tremendous and the landscape ecology is delicately balanced.

The main goals of the RESET Partnership:

(i) establish an environmental science training and educational exchange program for students and faculty of South Carolina, USA, and Siberia, Russia;

(ii) share expertise and experience to develop strategies for a number of environmental science areas, including

1) controlling air and water pollutants,

2) evaluating air and water quality (sampling and monitoring of pollutants),

3) atmospheric chemistry (ozone formation or acid rain chemistry),

4) mathematical modeling of pollutant atmospheric and aqueous dispersion,

5) regulating air and water pollutants,

6) evaluating the effects of pollution emissions on ecological health,

7) developing hazardous waste plans,

8) utilizing the latest Geographic Information Systems technology for monitoring environmental problems and evaluating resources.

As the first results of the RESET,

(i) a new Curriculum for training Russian students of geological, hydrogeological and geophisycal specializations in field of GIS technologies and environmental studies has deen worked out and a series of lectures on similar problems were delivered to students of STU by the personnel of the Russian Academy and American professors.

(ii) a student-faculty team carried out the first joint RESET expedition the Angara River and Bratsk water reservoir with participation of American and Russian scientists and students. The main objective was to perform a recannaissance survey of the entire water area of Angara basin and Bratsk man-made water reservoir. The participants executed sampling of water and sediments as well as conductivity, temperature, dissolved oxygen (CTD) depth profiles. The survey showed that the Angara River basin is an excellent polygon for research and educational training of students. Plans are to conduct Russian-American research practice in summer 1996 by camping on a barge moved by a tug ship and equipped with appropriate facilities for work.

We believe the Angara watershed, with a multitude of potentially interacting chemical, physical and biological processes, will provide our American and Russian trainees with many unique opportunities. Working collaboratively as a team and using the great scientific Russian and American experiance and advanced technologies of the environmental researches, the Russian and American trainees will employ new educational strategies and research technologies to solve concrete environmental problems, as well as gain new cross-cultural perspectives in an exciting and important international arena.

INDUCTION OF CYTOCHROME P-4501A1 AND B[A]P METABOLISM IN XENOPUS LAEVIS

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The cytochromes P-450 are the principal enzymes responsible for metabolic activation of chemical compounds. Xenobiotic metabolizm occurs mainly in the endoplasmic reticulum of liver, both in mammalian and nonmammalian organisms. Cytochrome P-4501A1 (CYP1A1) is the specific isoform active toward policyclyc aromatic hydrocarbon carcinogens.

The aim of the present study is to investigate the induction of CYP1A1 and its metabolic activity in liver and lung microsomes of Xenopus Laevis treated with benzo[a]pyrene (B[A]P). Moreover the covalent interactions of B[A]P metabolites with the cell macromolecules have been evaluated in the organs.

The induction of CYP1A1 isoform was performed by immunoblot analysis. The data obtained show that polyclonal antibodies, raised against rat CYP1A1, recognize a single band with apparent molecular weight between 55kD to 66kD as rat CYP1A1 in liver microsomes of Xenopus Laevis treated with 5mg/50g body weight B[A]P. In lung, a single band of the same molecular weight is evident both in control and treated samples.

In order to evaluate the metabolic activity and the covalent interaction of B[A]P metabolites, adult Xenopus females were injected with 7.3 microgram of 3HB[A]P and liver, gall bladder, lung, heart, muscle, ovary and fat bodies were collected 24h and 48h after injection. The amount of B[A]P in organs and radioactivity distribution in the organic phase, aqueous phase and protein fraction after ethyl acetate-

acetone extraction of organ homogenates were evaluated by liquid scintillation counting.

The results demonstrate that the level of radioactivity is higher in liver and gall bladder when compared with the other organs at 24h of treatment as a substantial increase of radioactivity is evident in lung, liver and gall bladder at 48h. Ethyl acetate-acetone extraction data indicate that B[A]P is more extensively metabolized by liver, in fact a large amount of water-soluble metabolites was detected in gall bladder. Extrahepatic organs show a low metabolic activity, and the fat bodies result to be a relevant storage site.

A consistent amount of radioactivity is found associated with protein and nucleic acid fractions, demonstrating that cell macromolecules are target for B[A]P metabolites. The DNA binding in liver and ovary decreases during 48h of treatment, suggesting that they possess a DNA repair mechanism; while DNA damage persists in lung.

These results indicate that after B[A]P treatment CYP1A1 is induced in a appreciable degree in liver, which results to be the primary site of biotransformation. The constitutive level of CYP1A1 and the persistence of DNA damage in lung suggest cancer susceptibility of this organ.

In conclusion the analysis of specific isoforms of cytochrome P-450 family enzymes induced by chemicals and the identification of target organs by metabolism and DNA damage studies result to be valuable tools to monitor the exposure to environmental pollutants.

THE CONCEPT OF WATER PROTECTIVE ACTIVITIES

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A number of chemical substances being present in the river water is a result of their inflow from various sources. Particularly, it holds true for metals. in water protective practice high contents of metals are usually associated with industrial sewage. A deeper treatment is then proposed as a measure to bring down the level of pollution. The approach is quite reasonable for the section of water body immediately adjacent to the water discharge. In the case of river this section has a length that depends on the amount and concentration of sewage, the water quality on the river itself and its flow rate. The role of the section as a source of pollution becomes essentially lower as the distance from an industrial installation increases.

In the basin of the Belaya river, in its upper stream, there is only industrial source of pollution with metals, that is the metallurgical plant. Iron is found sewage, waste gases and smoke of the plant. At 40 km downstream the Beloretsk underground water intake is located that has difficulties in treating water of iron and aluminium. Until recently, the source of pollution with aluminium remained unknown.

Iron and aluminium comes into the river system from soil and rocks. An anthropogenic constituent of these elements at the site of the underground water intake has been determined by calculating the amounts of iron and aluminium transported in a chosen time; with the exception of the part formed at the expense of natural background (across the catchment area experiencing no industrial effect).

The share of iron outflow with the sewage of the plant account for 1,1% of the total anthropogenic pollution, while that of precipitating waste gases and smoke is 0,09%.

The reasons of such superhigh iron and aluminium contents in the river water lie in the following. Over the course of a year the metallurgic plant discharges of tons of sulfur oxide to the atmosphere. Making contact with water vapour it produces an unstable sulfurous acid with further sulfuric one and the resulting formation of acid sludge characteristic for pH 5,2-5,5. The acid sludge washes iron and aluminium out of soil at the surface of the Earth. The process is aggravated by soil degradation and thickening caused by extensive forest exploitation and cattle pasturing that follows.

The concept of water protective activities to decrease the inflow of iron and aluminium to the river system includes: (1) the reduction of the anthropogenic effect upon the catchment area (selective forest felling instead of complete one, cattle pasturing prohibited in cleared spaces), (2) the diminution of volumes of discharge dioxide through improving the technologies at the metallurgical plant. The deeper treatment of iron will not lead to any essential decrease in the level of river pollution at the site of Beloretsk.

FORMATION OF ECOTONAL COMMUNITIES AS THE RESULT OF DYNAMICS OF RESERVOIRS REGIME IN THE CENTRAL ASIA

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Changes in the territory moistening caused by flooding of the reservoirs water or by drying of reservoir lead to formation of ecotonal communities.

Thus, on the bottom of the reservoir Sultan-Bent in Turkmenistan that had been dried up in 80-ies of our century the communities of sereal plants with ruderal plants (Arabidopsis pumila, Atriplex tatarica) with Alhagi pseudalhagi (18 species total) is forming on the bend from the reservoir bittom to the band of reservoir. Herbal-Tamarix (a lot of springs) with Tripolium vulgare and Alhagi pseudalhagi (17 species total) - on the bend from the reservoir bottom to the modern river Murgab is forming. These communities have form of narrow interrupting belts (1 meter wide, 20-30 meters long) along the named elements of relief.

On the other hand, on the sand dunes at the bands of now existing reservoir of 2nd Tedgenstroy the ecotones are forming too. Sereal-Salsola-Alhagi community with Calligonum setosum includes 34 species and is situated of the slope of the dune facing the reservoir, while Tamarix pentandra community with Calligonum setosum and ruderal plants - on the slope facing the dam surrounding the reservoir. In both these communities the heavy pasturing take place.

Those communities can serve as centers of future settling of species and promote to formation of primary tugais on the bottoms of dry reservoirs. They can also be the refugiums for species when the new reservoir is constructed. So the ecotonal communities are very valuable and must be protected as hotbeds of biodiversity. Regimes of reservoirs must keep in mind the probable ecological consequences and tasks of nature conservation.

ON THE PROBLEMS OF WATER UTILIZATION AND ECOLOGICALLY ADMISSIBLE QUANTITIES OF RIVER-FLOW ABSTRACTION

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The modern condition of Russia's water resources demonstrates that the decades-accumulated problems of rational utilization and protection of Russia's water resources from pollution and depletion have not only been satiafactorily solved, but even aggravated during the recent years.

Notwithstanding certain reduction of overall water consumption (by 14 %), provoked by the recent years' sharp slump in the industrial and agricultural production, an increase of the Gross Domestic Product's water demand in general, as well as that of certain branches of the national economy, has been observed. Thus, from 1990 to 1994 the specific fresh water consumption for the Gross Domestic Product increased by 37 %. The water demand increase was especially high in such industries as machine-building - more than 3 times, light industry - 2.5 times, electricity supply and ferrous metallurgy - 1.5 times, respectively, pulp and paper industry - 1.4 times, which is the evidence of a wide-scale violation and reduction of the use of the existing less water-intensive technologies.

The modern level of the utilization of water resources is not justified either from the ecological, or the economic point of view. The existiing technologies and technical means employed in the industrial and agricultural production sectors allow to reduce the ecologically dangerous volume of water consumption, especially in the Southern regions of Russia. Therefore, the first priority task (whose solution does not require additional capital investments) is the water abstraction rationalization by means of strict control of the water utilization according to quantitative and qualitative data.

One of the main directions in the realization of the policy of water bodies' protection and rational utilization is the task of of establishing of an ecologically justified limit for the consumptive surface flow consumption.

A body of research workers of the Ecological Commission within the framework of the State Program "The Ecological Security of Russia" elaborated methodological approaches to the solution of the task of norm-setting for the reduction of the anthropogenic reduction of the surface flow on the pattern of the Don and the Kuban rivers, the Azov Sea, as well as the Ural River, the lower flow of the Volga and the Northern part of the Caspian Sea.(1).

The essence of the approach in the evaluation of the ecologically admissible consumptive river-flow abstraction is the retention of the ecologically safe and stable condition of the water ecosystem when

changes of the structural and functional organisation are taking place within the limits of tolerancy of the natural hydrogenesis stage and the ability of natural complexes for self-regulation, -clarification and -reproduction, are not undermined. (2).

A number of methods and criteria on the basis of which rationing of consumptive water utilization, as well as the evaluation of the degree of disturbance of water ecosystems, are offered. The most important of the criteria are: conditions for natural reproduction of hydrobionts, their harvesting reserves, the principal change of floristic and faunistic communities, their populations' and species' diversity; the transition of the biological productivity of water ecosystems to a lower level; changes in the ichthyofauna's structure at the expense of the reduction of valuable fish species and the increase of less valuable ones; violation of river-beds, disturbance of the delta formation process and the formation of estuary bars resulting in the degradation of estuary natural complexes.

These criteria, in their turn, are determining such data as water expenditure and flow in the years of different water catchment volumes, the quantities and terms of spring and summer high water, the flood-land and delta spill areas, data on the water flow regime of river-bed and flood land spawning grounds, turbidity, temperature and oxygen saturation conditions, salinity, fishes' fattening areas, level oscillation conditions of the sea, etc.

On the basis of the recommended methodological approaches the ecological flow-off and the norms of the maximum allowable limits of consumptive utilization of the flow-off for the above mentioned river basins, including the closing reservoirs, are calculated.

The level of consumptive utilisation of the river flow is remaining dangerous for water ecological systems of the Southern regions. The ecological situation there is aggravated by growing unpurified sewage runoff to water bodies.

We consider it important and timely to issue an officially implemented standard-setting and methodological document on ecological rationing for consumptive river-flow utilization.

It is also necessary to elaborate and realize a program of stage-by-stage reduction of water consumption and provision for ecologically safe river-flow consumption, in the first turn for the rivers of the Southern slope of the European Part of the Country (EPC).

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ARAL SEA PROBLEM - THE REGIONAL PROGRAM OF SOLUTION

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The Aral Sea and it's basin has a sed reputation in result of interests of the world society to problem of degradation of water objects wide in the world, where Aral Sea is the largest. In the arid zone, which includes the Aral sea basin, excepting his mounain's part, water is object for existence of al alive and this is important element of nature. At the all times water resources played the role of the basis for an economy, social policy and environment.

The declaration of the independence by the five Republics of the Central Asia was not the case of rise "misunderstanding" in management by common water resources of the Aral sea basin. From the end of 1991 the joint water management with the help of the Interstate Basin Organizations was taken by the Interstate Coordination Water Commission (ICWC), who confirmed the community of the all waters and the interest of the Aral sea basin's States in saving of joint management by all these waters, and was leaved behind the other similar Interstate agreeents in the world. Elaborated the common approaches for the limits of usage and operative principles for water resources distribution from Amudarya and Syrdarya rivers, ICWC beginning works out of the common line for perspective planning and started an activity for creation of new Interstate Council for the Aral sea problem and it's Executive Committee (EC of ICAS). As a result there was elaborated "The plan of concrete activity for improvement of ecological and socio-economic situation within the Aral sea basin", which was confirmed by the Heads of States of the Central Asia in Nukus on 11th of January 1994.

At the present time "Plan of concrete activity" with the support of international sponsors is going on the 4 of 8 programs and on the 7 of 19 subprograms of these large complex of works:

- Program 1 - Regional Water Resources Management Strategy, which financing by Global Ecological Facility (GEF) through the World Bank.
- Program 3 - "Water Quality Management" - GEF and the Netherlands Development Found.
- Program 4 - Environmental studies of the Aral Sea Basin, "Restoration of the North Aral Sea, Wetlands Restoration" - The Netherlands and Italian Development Founds.
- Program 5 - "Clean Water and Health" - from the Bank of Kuwait.

In addition the program "Water Resources Management and Agricultural Production" (WARMAP), financing by the European Union, partial develops the Program 1 - "Water strategy", and also partial recovered and developed some others programs.

The Water strategy is considering as combination of regional strategy with national water mangement strategies of five States of the Aral Sea Basin. The strategy is based on the main topics of the International water low about equal and reasonble mutual-profitable usage of water and protection of environment. The strategy directed for strong connection between requirements and rights of each State for satisfaction of water demands with long-term perspectives for saving of water objects (rivers, seas, natural landscapes with water eleents) for future human generation. It's necessary to make a complex of principle (strategy, economic and engineering) decisions, positions, norms, which will be in form of Interstate agreements and treaties, and institutional basis. These must be a "rule of game for regulation the direction of sutainable development of water resources in the region with taking into consideration their deficit in conditions of arid climate and possibilities of conflict situation around the water.

The decreasing of the water quality in the rivers is a one of the two importance ecological problems in the region. It is known that main source for water pollution is irrigation, which bring into the rivers salt, pesticides, etc. The limitation of application chemical substances in irrigation at last years bring to some reduce of this pollution at the background of the decreasing of water usage from 17.5 thousand m^3/ha - in 1980 year, to 12.6 thousand m^3/ha - in 1994 year. The solution of the water pollution problem is not only in construction of big collectors as, for instance, Right Bank collector along the Amudarya river (because they are excepting a big volume of return waters), but in the complex of reliable works addressed to improvement of principles of management by irrigation and drainage. The problem can be solved by the prevent of the industrial pollutions too. From this point of view the selection of the most reliable and profitable variant of the Aral sea watering is very important one as an identification of the regional water demands for usage and distribution of limited water resources between independent States.

The situation with the Aral Sea and it's coast is the basis point of attention in common regional program. We are outcoming from joint position about impossibility for restoration of Aral Sea in it's natural conditions without any catastrophic damages for socio-economic situation in region. As a main idea we are take saving of the Aral sea coast and formation such ecoogical profile, that provide the formation here natural landscape with deep of sea and creating a sustainability in future water ecological systems. These systems will provide productivity of territory, exceeding last volume and impossibility the further degradation of process. Take into account this parts it's necessary, from one hand, to consider the ecological requirements for different natural subjects with the purpose creation microclimate of settlement zones, developing fishing and pasture, delta restoration, struggle with devastation and salt transfer. From another hand, - to consider all possible engineering aspects for decision the problem of the Aral Sea and it's coast. The next step is to find the real solution with taking into account the constrains of water resources and financial possibility. With taking into consideration that the Aral Sea and it's coast are the independent water user within the region, one of more important issues is to define these requirements and estimate of possibly withdrawal to the both deltas. If or North part of sea the requirements for water definited about 6-8 km^3, then for zone of Amudarya it is in the interval from 8 to 20 km^3. Available resource for Syrdarya, including delta and natural complex, was estimated about 3.5-9.0 km^3, and for Amudarya - 4.5-30.0 km^3, with the average meaning 11 km^3 of the fresh water.

Connected with the "Plan of concrete activity" foreign donors allowed, although not full measure, but to continue the work of the different organizations by development and research, of direct on improvement and socio-economic issues in the Aral Sea Basin, and let to give a new life to the tide faire of the works and programs, which were designated and developed in the past decade, especially on the border from 1986 to 1991. Collaboration with the international experts led to look from outside and allowed to us to give a new assessment and find a new methods to solve the Aral Sea problems and use the experience of other regions, where are the similar problems in our world.

CYANOBACTERIAL ASSOCIATIONS AS THE BASE OF SUCSECCIAN PROCESS IN TECHNOGENIC SYSTEMS

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The aim of our investigations is a search of natural associations which are able include to their exchange harddecomposing combinations, products of theirs destruction; and able in the installation prevail over local microorganisms.

The objects of investigations are technogenic waters ecosystems, which about thirty years aver accumulation of sewers, including sulfur lignin; sewage treatment constructions, heap of liquid wastes.

From active destruct parts of water technogenic systems was emitted specific associations of microorganisms, which construct in the microecosystem structure cianobacterial.

It has relative substrate and energetic independence from ingredients of sewage, at the expense itself biochemical ties.

The association, in interaction with microorganisms of sewage, forms the pleomorph active staff, n the base of symbiose and antagonism. It allows utilization of hard decomposing and toxic components.

The results of our work allows to consider technogenic cyanobacterial associations as a perspective biotechnological objects. On the base of our investigations was offers effective method of treatment sewage from sulfur lignin.

Cyanobacterial associations may be used as a test for recultivation not only waters, but ground ecosystems.

ARTIFICIAL PRECIPITATION ENHANCEMENT AS AN ADDITIONAL SOURCE OF WATER RESOURCES AT THE REGION

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The artificial precipitation enhancement may become an important source of additional water resources for arid regions with a poorly developed hydrographic network and with an unsufficient for normal moisture-supply quantity of natural precipitation.

Proposed are the methods for the region cloudness potential evaluation with the object of possibilities and expediency determination of rain increase operations carrying out at the given region.

Proposed are the worked out and checked in practice method of precipitation artificial enhancement over extensive territories and the technology of activity upon the clouds of various types.

Proposed are the ground-base computerized meteorological radar system "MRL-INFO" and an aircraft board-base set of equipment enabling operative and highly-efficient carrying out of work upon the clouds.

Proposed are the approved methods for estimations of the rain increase operations physical and economical efficiency.

Since 1986 the Scientific and Production Geophysical Center carries out the rain increase operations at the North Caucasus on the area of 9 mln hectares. In May - June the average annual increment of the liquid precipitation is 16 mm, i.e. about 1.5 cubic km on the whole operational area. This is equal to the monthly flowing rate of the Kouma river (the main natural waterway of the Stavropol region) near Boudyonnovsk in droughty years. According to the known relationship of the yield capacity on the precipitation it provides for the crop increment of the winter wheat up to 80 kg/ha that only on Stavropol region on the sowing area more than 2 mln hectares gives about 200000 ton of winter wheat per year.

ELABORATION OF SCIENTIFIC GROUNDS FOR ENVIRONMENTAL MEDICAL FORECASTING UNDER CHANGEABLE HYDROLOGICAL CONDITIONS

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The necessity to forecast environmental medical after-effects of a changeable hydrological situation is determined by special features of current environmental problems with acute processes and phenomena linked with powerful anthropogenic press on natural systems. The qualitative and quantitative exhaustion of water resources observed in Russia, drinking water resources pollution, changeable territory water rate, changeable inland seas levels (the Caspian sea), negative after-effects of hydrotechnical constructions (canals, water reservoirs, irrigation systems and the deterioration of public living conditions stemmed from all of the preceding, make one consider medical aspects of the problems with much attention. Most important are health deviations, birth rate, adaptation and morbidity of population. It is necessary to improve theoretical grounds of preventive activity based on environmental medical views to clarify cause-and-effect mechanisms of life endurance and health formation of human community and habitat. The role of water factor therewith is of great importance due to a wide range of direct and indirect impact on terms of habitat and human health. Consideration of this impact in the context of changeable

hydrological situation from the territory point of view makes possible to build models assisting in specifying priority and sphere of protective and preventive measures in time and space.

The environmental medical approach suggested to solve the problem is based on updated views of environmental epidemiology and preventive medicine about direct and indirect water impact on living conditions and the state of public health. This approach includes prognostic possibilities of scientific subjects which study hydrological situation (hydrology, hydrogeology, hydrobiology, hydrochemistry, ecology of non-reservoir hydromorphic biocomplexes) and health formation and public morbidity process (hygiene, epidemiology, infectious and non-infectious diseases, parasitology, medical genetics).

The proposed methodology is supposed to use medical interpretations of possible hydrological changes (regime, continental water quality and quantity) effecting medico-demographic processes, labor activity, sanitary conditions of public water use, recreation conditions, microclimate of habitation, food supply and quality. Thus the proposed approach provides the use of the assessed medical criteria assisting in the analysis and forecasting of the state of water resources, water and surface ecosystems, social processes linked with the dynamics of hydrological situation. In this case Russia represents a large-scale model which allows theoretical and methodological calculations with wide and global meaning.

FORMATION OF RESOURCE AND WATER QUALITY IN THE RIVER IN THE PERIOD OF RAIN FLOODS

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Small rivers form one of the main group of hydrographic net. Considerable anthropogenic loads on the water-catch areas cause their degradation much more easier then of the middle and great rivers, as their ability to self-refinement and self-restoration not so strong. The state of any concrete river is defined first of all by the state of the whole basin. The river basins - are the nature systems with their stable moisture-exchange, where water resources and their quality are the main integral characteristics of the moisture-exchange process between atmosphere and the surface of water catch area. By the similar climate conditions the formation of the resource and quality of the river run-off is defined by the geomorphology of the basin, by soil conditions and by the degree of anthropogenic influence to the water-catch area.

The accumulation of the moisture at the water-catch area plays an important role in the process of the river run-off formation, being the result of interaction of the climate and physic-geographical factors of the run-off formation. They impact on the volume of the surface and underground waters both in the period of snow-melting and during the summer-autumn rains, and therefore, define the character of the run-off hydrographer.

In 1993-1995 there was held in RosNIIVKh the investigation of the resource formation and of the water quality in interdependence with the run-off defining factors of the river Aramilka, which flows 20 km far from Ekaterinburg. The moisture - accumulation was defined on the typical for the river basin surface, in the layers 0-50 and 0-100 cm. The underground waters in the period of investigation laid much more deeper - 2,5 m.

The monitoring , which was held, allow to define the following peculiarities of the resource - formation and of water quality in the period of the rain floods: considerable increasing of the water discharge in the river (in 6-14 times in comparison with the river -bed) and of concentration of the controlled ingredients. All this information showed the existence of close interconnections between the water discharge in the river and moisture - accumulation in the layers 0-50 and 0-100 cm. In the first case the correlation coefficient was 0,80 in the second case - 0,74. By the rain floods the formation of the water flow takes place mainly because of the hanged surface flow without participation of the underground waters. The existing close interconnection between the moisture - accumulation in the upper layer of the soil and water discharge in the river shows atmosphere nutrition, which corresponds to the general definition of the small rivers.

Based on these investigations one can make the following summary:

the main factor of the formation of water quality in the period of summer rain floods is the character of the surface: the relief, type of the soils, agricultural background (including the quantity of the fertilizers);

the accumulated moisture in the water-catch area may be used for restoration of the flow rows and for prognosis of its resource and quality.

FISHERY AND HYDROLOGICAL ASPECTS OF NORM-SETTING IN REGARD TO THE TRANSFORMATION OF RIVERS' RUNOFF IN THE BASINS OF THE SOUTHERN SEAS RUSSIA

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The problem of efficient use of water resources is one of the most important for the basins of southern seas of Russia where under the influence of human activity the river runoff is much lower than ecologically permissible. In this connection the hydrological norm-setting of water consumption and transformations of spatio-temporal structure of runoff variations in the basins of the Azov Sea, the North Caspian Sea and of the eastern part of the Black Sea has been made.

It is known that resources are the main index which represents the effect of consumption, regulations, territorial redistribution of the river runoff, these reserves serve also as a criterion of the management of water resources and of the regime of water-bodies (waterways) with commercial fisheries. The condition of fish stocks is an index of ecological "well-being" of water and near-water ecosystems, their preservation and restoration at the level approaching the natural one leads to the preservation of the environment and the health of humans. The following items have been developed: a system of hydro-ecological, biological, hydroeconomic indices and criteria; classification of degrees of ecological consequences of water consumption including the four conditions of water ecosystems: conditionally stable, transitional, critical and catastrophic. The following degrees of depletion of water resources caused by human activities correspond to the abovementioned items: ecologically admissible anthropogenic reduction of river runoff (EAAR), ecologically admissible water consumption (EAWC), ecologically maximum admissible anthropogenic reduction of river runoff (EMAAR) and ecologically maximum admissible water consumption (EMAWC), ecologically critical volume of the river runoff (ECrVRR) and ecologically critical water consumption (ECrWC), ecologically catastrophic volume of the river runoff (ECatVRR) and ecologically catastrophic water consumption (ECatWC). Methods for the evaluation of the said levels of the river runoff and its consumption have been developed.

As a result, it has been found that for the rivers in the Azov Sea Basin (the Don and the Cuban) EAAR, EMAAR, ECrVRR and ECatVRR make, res., 37-39, 35-36, 29-30 and 24-26 km^3/year (more than half of these amounts fall on the spring period), while EAWC, EMAWC, ECrWC and ECatWC constitute 2/0-2.5 (5-6 %), 5-6 (14-15 %), 9.0-12.5 (24-30 %) and 13-17.5 (33-42 %) km^3/year, res. The volume of the annual consumption of the Volga runoff amounts at a high level of the Caspian Sea to 23 -25 km^3 (10 %) while at -28.5 abs.m. and below this volume is 18 km^3 (6.5 %). One should bear in mind that the volume of the runoff of the Volga at the time of spring flooding should not fall below 120-130 km^3 and annual runoff should not be less than 249 km^3. The critical state occurs at the spring runoff below 90 km^3 and the annual runoff in the range of 173-183 km^3, while a catastrophic situation occurs when these figures fall below 60 km^3 and 141 km^3, res. The maximum consumption of the river runoff flowing into the eastern part of the Black Sea should not exceed 20 %.

Meanwhile, the hydroecological conditions for the fish reproduction within the Volga river bed, in its flood valley and in the delta are in regard to the annual runoff volume below the ecologically admissible level, while in the Azov Sea Bain these conditions lie between the ecologically admissible and critical. Regarding the spring runoff which is the most important for the fisheries, they are in the former case close to the critical state and in the latter approach the state of catastrophic.

So as a preserve and restore the environment, in particular, the quality of fisheries in the southern seas of Russia, the current practice of the operation of water reservoirs must be changed. The extensive use of water resources must be replaced by the intensive one which will reduce the irretrievable consumption and bring it to an admissible norm.

ON DESIGNING OF COMPREHENSIVE PROGRAMME FOR RECOVERY OF SMALL - AND MEDIUM-SIZE RIVERS OF THE REPUBLIC OF TATARSTAN AND ECOLOGICALLY EFFICIENT FARMING WITHIN THEIR CATCHMENT AREAS

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Status of both rivers and lands of their catchment areas become worse simultaneously. Soil cover, together with fertilizers and manures applied, is washed out by surface flows formed over the river catchment area. Eroded particles are then transported by water down to river, thereby causing its contamination and silting - up.

For this reason, it is worthwhile to restore rivers and lands of their basins also simultaneously and according to a comprehensive programme drawn up as a complex of basin schemes for every river of the Republic. Basin of a river is intended to be presented as separated into basins of small tributory streams and/or the so-called elementary basins, so that all the package of measures could be completed within a season and their ecological effect would become apparent beginning from the next season, followed by increasing of the effect.

The package of measures for the elementary basins to be accomplished, includes:

- contour planting of forest belts across the slope of a catchment area (not rectilinearly), so that cultivation of the land across the slope all the way of tillage machines (in combination with erosion-preventive agricultural methods) for snow and water retention be possible. Width of spaces between forest belts is set up as 200 to 400 m;
- rectangular forest-meadow planting along banks of gullies and gulches as well as on the adjacent abrupt slopes to make " forest margin" effect. The average sizes of the rectangulars are 1 to 2 hectare (s). They are sown to grass and used on time for haymaking. Their boundaries are planted around with three-row forest belts including as many kinds of trees and shrubs (among them fruit and berry plantations) as possible. As a result, demands for pesticides in the course of time will disappear;
- fixing of separating gully summits with special constructions;
- formation of cascades of rock-fill dams along bottoms of gullies and gulches;
- formation of ponds and water storage basins by flooding lands of small value - to accumulate flood water.

The programme is planned to be accomplished starting from the elementary basins situated at the upper edge of river basin, consistently extending it down to mouth of the river. At the same time, a cascade of riverbed diversion dams with low-capacity water power units on them is to be erected. Owing to the dams, sufficient moistening of flood meadows, electric energy production and providing population for everyday necessities of water would take place.

Ponds and water storage basins built at heads of river (on the elementary basins) would raise river water content during low water period through release of pond water, as well as make for formation of irrigated grasslands to prevent pasturage along the banks of river and gullies.

Population of river basin is sipplies mostly with underground water. Therefore, to prevent pollution, allocation of priorities for bulding sewage systems and wastewater treatment plants would be planned, in accordance with the extent to which the underground water is protected by biological conditions of the basin, as well as depending on rates of gas supply of the countryside because of expected sharp rise of water consumption and domestic wastewater producing.

The basin schemes, besides the tasks mentioned, will also contain mechanisms of their realization, uncluding appointment of specific executors, financing resources and terms of realization.

THEMATIC CLASSIFICATION OF COASTAL ECOSYSTEMS USING LANDSAT-TM DATA

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In a densely populated island like Sicily, the environmental quality of its coastal waters may be exposed to a number of marine contamination hazards, associated with a whole range of coastal activities. An adequate management strategy must rely on reliable information, on which a protection strategy needs to be based.

This study was sponsored by the Commission of the European Communities, through Regione Siciliano, as a part of a research project on Water Resources and Water Management. The aim was to evaluate the usefulness and effectiveness of remote sensing techniques, in assessing water quality of coastal environment, and providing valid data for coastal resource management.

Landsat-TM (Thematic Mapper) data were used, to map water quality parameters in areas under intense and anthropogenic and industrial pressures. The water quality parameters mapped were chlorophyll a content and water temperature of surface waters, water visibility as measured by Secchi disk, suspended solids, and turbidity. These water parameters are indicative of land-based discharges, as well as water productivity, which may be enhanced, leading to eutrophic conditions and poor water quality. The areas under investigations were the coastal zone of Augusta Bay, and a strip of coast to the South of Catania.

Digital data of the study areas were acquired on different dates, and calibrated by sea-truth data collected from the field near-simultaneously with satellite overpass.

Mathematical models were developed, validated, and then applied to the study areas, in order to generate color- coded images, each depicting the distribution of a selected water quality parameter in each area.

Color-coded imagery provided a wealth of new information, which was interpreted, taking into account the land-use of the coastline, as well as known and suspected land-based discharges of waste waters from various sources.

Landsat-TM data proved useful and effective for the intended application, and may contribute to a data bank on water quality in Sicilian coastal waters, which may be updated periodically, so as to provide useful information for management of resources.

WATER RESOURCES PREDISPOSITION TO POLLUTION THROUGH ATMOSPHERE

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Factors and some consequences of land surface and water resources pollution through atmosphere are considered. At present time one of the major environmental problems is atmosphere pollution. The problem has both national and international importance. In particular it does harm to land and water resources directly and/or indirectly. The land and water pollution through atmosphere depends on many factors. Different types of land surface and water resources have various predisposition to the pollution through atmosphere. In order to prevent or decrease negative consequence of the pollution it is necessary to know area data concerning the potential pollution through atmosphere. Methods were worked out and a map-scheme of the potential area airsol pollution was developed for Minsk district.

INFLUENCE OF HYDROMETEOROLOGICAL FACTORS ON THE FORMING OF WATER QUALITY IN THE IVANKOVO RESERVOIR

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The appearing of the problem of water quality in the water objects, its monitoring and forecasting is the result of the intensive using of water resources, of the increasing importance of water factor in the economic and social development of society.

Purring the last years the use of reservoirs for supplying the big cities with water is widely used, so the problem of water quality in reservoirs for drinking is now greatly important. One of such reservoirs is Ivankovo reservoir which is the main source of the water supplying of Moscow.

The leading part in forming the water quality of Ivankovo reservoir belongs to the water inflow form Volga and Tvertsa rivers, the entering of pollution from the uninspected resources, with the ground water and waste water of Tver town, and also internal reservoir processes, which in their turn are dependent of hydrometeorological factors, This work is devoted to the revealing of the part of those factors in forming water quality of Ivankovo reservoir, made on the basis o of the monitoring observations of Water Problems Institute in summer of 1992-1993 years and literal information.

The analysis of literal resources and our own observations revealed the hard communication of water quality characteristics with the volume of water inflow into reservoir, with the air temperature and water temperature, precipitations volume falled on the water body and with level regime of reservoir.

Different meteorological conditions in summer 1992-1993 years with the equal water inflow volumes into the reservoir determined the different character of the internal reservoir processes and as a result of this the individual indexes of hydrochemical regime in tow years were different: water mineralization and concentration of main yonns, the maintenance of ammonium nitrogen and nitrate nitrogen, oxygen, dissolved in water, pH etc.

The explorations revealed that in summer 1992-1993 years there was no increasing of water pollution with biogens. The exponents of colourness and permanganate oxidizability were as usual high, exceeding the permissible degrees. There was observed the increasing of BOD_5 as compared with the beginning of 80-s; that shows the increasing pollution of reservoir with organic matters.

Taking into account the great importance of hydrometeorological factors in forming the water quality in Ivankovo reservoir by monitoring observations one should not stop after the taking water samples for chemical analysis, but it is also necessary to do the explorations of water, thermal and hydrodynamic regimes of the reservoir; and hydrometeorological situation at the watershed. Traditional physics-chemical methods at the monitoring of water objects should be added with the methods of biotests and bioindication, that should allow to come to the more perfect form of monitoring-ecological.

THE METALS IN UVODSKOYE RESERVOIR IN IVANOVO

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The influence of the metal's content on the quality of drinking water and on the people's health is well-known. Uvodskoye reservoir (the are of the mirror is 10,4 sq. km, the area watershed is 1040 sq. km) is the main source of Ivanovo's water-supply (up to 80%). Preparation of drinking water from the reservoir includes filtering and chlorinating. Naturally, the metals in dissolving form, including cation form, are not extracted and make the water's qualities worse. That's why during 1993-1995 the measurements of the metal's content in water, bottom layers, silty water, precipitation and in waterside soil had been taking place, including determination of their being's main forms. The average results from 5-8 stations of observation for the whole period of time are in tables 1 and 2.

Table 1.The metal's concentration in Uvodskoye reservoir water.

Element	Concentrations, μg/l			
	Winter	Spring	Summer	Autumn
Copper	(2-6)/4,5	(2-10)/6,5	(1-5)/1,5	(2-8)/4
Zinc	(3-11)/9	(5-30)/11	(8-34)/19	(1-36)/12
Nickel	(3-10)/9	(4-31)/9	(3-25)/8	(1-32)/14
Chromium	(2-15)/10	(4-25)/13	(6-28)/12	(3-21)/9
Cadmium	(0,8-1,5)/1,1	(0,1-3)/1,2	(0,2-0,9)/0,6	(0,1-0,8)/0,4
Lead	(1-9)/5	(2-62)/21	(0-36)/7	(1-27)/9
Mercury	0,05	0,028	0,067	0,016

Table 2. The metal's content in atmospheric precipitation, bottom layers and silty water in Uvodskoye reservoir.

Element	Content			
	Bottom layers, mg/kg	Silty water, μg/l	Layer of snow, μg/l	Rain precipit, μg/l
Copper	(1-13,1)/5,4	(11-50)/29	(306)/4	6,0
Zinc	(6-51,7)/18,6	(75-180)/130	(8-21)/13	46
Nickel	(0,5-6,3)/2,8	(30-260)/120	(3-5)/4	4,0
Chromium	(0,6-3,6)/1,7	(150-970)/350	(2-15)/8	16
Cadmium	(0,1-0,6)/0,2	(0,4-3,7)/1,9	(0,1-1,6)/0,8	0,8
Lead	(6,6-33)/18,7	(35-140)/80	(1-6)/3	2,0
Mercury	(0,01-10)/0,7	(0,5-1,4)/0,9	<0,05	0,009

Note: the range of variation is in brackets, denominator is the average.

The analysis of the received data shows that in phases of the intensive water exchange (in spring and in autumn) in surface layer of water the concentration of copper and lead increases, that agree with the increased content of these elements in silty water, layer of snow, raining precipitation are characterized by the increased content of zinc. The valuations show that the main source of zinc, copper and nickel in Uvodskoye reservoir is the atmospheric precipitation and the waterside soil.

More detailed investigations show, that copper, zinc, nickel, chromium, cadmium and lead migrated mainly in the dissolved form (50-96%, and mercury has about half of the total content. The cation form, consisting mainly of free cations and hydroxyforms, with consideration of the high importance of the redox potential for surface layers of water forms about 50% for copper, nickel and chromium and 36% for cadmium.

ENVIRONMENTAL AUDITING OF WATER RESEARCH MANAGEMENT PROJECTS

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Environmental auditing became widespread for evaluation of accordance of different human activity fields to ecological norms, laws, and rules, and also to elaborate correcting measures in environmental protection. Environmental auditing of water resources management systems (water economic and hydrotechnical reclamation) seems to be a perspective direction of research and a real way of solving urgent practical problems.

It is proposed to introduce a common concept of a project of water resources management (water economic project) system by environmental auditing, covering all phases of developing and realization, including the origination of the project's idea, preproject stages, actual designing, building, operating, exploiting, reconstructing and so on, up to the dismantling of system structures.

Many features of water economic projects are defined by the specific nature of water as a natural resource: irreplaceability, regenerativity, the danger of exhausting, amount and quality variability, presence of natural transfer, interconnection with other natural and social-economic systems, and significance of the damage by breakdowns of water objects.

The water economic projects with energetical and industrial purposes, projects of municipal and rural water supply are similar to industrial projects by the fact that their influence on the environment is a osecondaryn undesired result of their basic action.The main aim of the environmental auditing for such projects is the prevention, moderating, and elimination of their realization aftereffects.

Irrigational water economic projects (hydrotechnical reclamation projects) are created exactly with the aim to influence natural ecosystems. Therefore, the main aim of environmental auditing of hydrotechnical reclamation projects is the control of correspondence of duration, intensity, and scale of realized actions to admissible limits of ecologically safe loads on the concrete ecosystems.

The normative-methodical basis of the environmental auditing of hydro-technical reclamation projects is presented by: (i) works on evaluation of influence on environment; (ii) normatives for ecological substantiation of separate project stages; (iii) risk concept allowing to overcome the shortcomings of the normative approach; (iiii) international, country, regional, and branch legislative and legal acts regulating the ecosystem exploitation and, in particular, the water usage.

The necessity of unification of documents on environmental auditing of hydrotechnical reclamation projects demands achieving the agreement about concepts (notions) characterizing the ecosystems state and anthropogenic loads. In report we propose definitions of following concepts: the action, influence zone - contour; the action period (admissible value); the elastic, reversible and irreversible ecosystem deformations; the ecologically safe project.

The auditing is based on the study of concrete information on the system operation and on finding the causes of unfavorable environ-ment changes, i.e., on solving problems in some way inverse to problems of evaluation of the action on the environment. The collection, handling, analysis, and documenta-tion of information needed for effective auditing is one of the important problems of monitoring.

METHODICAL BASIS OF WATER PROTECTION AREA DETERMINATION

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At present time in many countries of the world a faulty practice of the management and use (industrial, agricultural, urban, recreation, forestry, transport etc.) of the territories adjacent to the water bodies is developed. This fact inevitably disturbs the ecological balance within the system "watershed-waterbody" and impacts on terrestrial and aquatic complexes and on the water quality. In this connection a need of a buffer water protection areas determination arises; nevertheless in many cases their boundaries are limited by administrative order without taking into account the knotty interrelations and interdependencies between different natural components and the landscape structure peculiarity feature of a territory.

Methodical basis of water protection area determination must be founded on the landscape natural stability, its resistance and absorption capacities and on the diversity and mosaic character of the ecosystems natural complexes.

The principal material for making such a work are the results of comprehensive physico-geographical investigations, namely: geological, hydrogeological, geomorphological, soil, vegetation and land use maps. Otherside it is necessary to dispose the aerial and cosmic photographs of different scale depend-

ing on the research object. The availability of the different scale material of good quality allows to make an analysis of the general situation on the watershed and to determine the key and control plots to obtain more specific information and quantity indices for each component. Elaboration of quantity criteria is an essential stage of this work since they allow to estimate the admissible load for each natural user. The admissible load is estimated for each landscape component and is limited by the more vulnerable element of the 'watershed-waterbody system' and within it - by the more vulnerable component. Only in this case there is an opportunity to minimize the negative consequences of the economy use of the water protection area. The natural components must be equal number of essential parameters, e.g. if there were taken 5 criteria for soils it will be taken 5 indices for vegetation, relief, etc. Within each factor (natural component) he quantity criteria have a different specific weight. The authors' experience in the field of the recreational classification of the reservoirs and the adjacent territories has been taken as a basis for assessment (classification) of other from of resources use. For easier treatment and comparison each criteria has its mark within a three-mark system: the highest mark (3) demonstrates that this criteria satisfies at most the demands of a resources user on a local plot. The highest mark sum corresponds to the highest class of the resources potential and that the evaluated area has a maximum resistance to anthropogenic load. So, the plots of water protection area having a highest assessment mark much more narrow, and their concrete dimensions depend on individual plot's characteristics (in particular, on the soil-vegetation cover, relief, geology and geochemistry). And vise versa, the plots of the water protection area having the lowest assessment mark are wither in virtue of their low resistance and absorption characteristics. On the authors' data the width of water protection area of Ivankovo reservoir (on the Volga river) vacillates from 0,5 km to 5,0 km on dependency on landscape structure characteristics of the territory and of the kinds of their economy use.

BIOGEOCHEMICAL INDICATION OF HEAVY METALS POLLUTION OF THE AMUR RIVER WATER ON THE BASE DIATOM ALGAE

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It has been determinated the species diversity of diatoms in the Amur basin, the ecological of their habitation in water ecosystems and the levels of heavy metal concentration in them.

On the base of generalization of the obtained material, there has been worked out diatomic method for biogeochemical indication or water quality in river, streams and pools of the Amur basin. This method is characterized by high sensitivity and has no foreign analogues. There has been established the scientific principles and methodological recommendation of the Amur and its tributaries waters by metals as background ecosystems so in technogenic ones.

RESEARCH OF SOME UNHEALTHY SUBSTANCES' INFLUENCE ON PROCESSES OF NATURAL WATERS' SELF - RECTIFICATION

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One of the actual problems of the recent time is a natural waters' protection from chemical pollutions. For working out of effective measures on sewage disposal it is necessary to have an exact information about a nature of pollutants, their influence on the processes of natural waters' self- rectification and the establishment of unhealthy substances' maximum available concentrations in it. Some of these unhealthy substances are 2-methil-5-vinil-piridine, a-chlore-ethyl- phosphorus acid's benz-imidazole solt and lauril-pyridinium-sulphate. The former is in sewage of rubber industry, the two later are in sewage of textile industry.

In this work the results of the research of different concentrations' influence of MVP, bipheran and LPS on the change's dynamics of the content of ammonia-ion, nitrate-ion and nitrite-ion in natural waters are adduced. The analysis of the received results allowed to reveal the regularities on which grounds the maximum allowable concentrations of the investigated unhealthy substances have been established. The reasons of observed facts have been considered with regard for their nature.

The research of the MVP's influence on a nitrificational equilibrium have been carried out in 0,0001; 0,001; 0,01; 0,1 and 1,0 mg\l this substance's presence, bipheran- in presence of 0,001; 0,01; 0,1; 1,0 and 10 mg\l; LPS- in presence 0,001; 0,01; 0,1; 0,05; 0,1 and 0,5 mg\l. All investigated solutions have been prepared in a natural water; others includ-

ing the initial unhealthy substances solutions have been prepared in bidistillate.

In the most concentrated solutions of MVP the content of nitrate- ion stays much lower than in the control solutions during the days of research. Taking into account MVP is a stronger base than pyridine and it has a tendency to oxidation in acid mediums; and the fact nitrate- ion is an oxidiser, it can be supposed that some removal of the ion-equilibrium of water and the partial oxidation of MVP take place with putting MVP into investigated medium. From the distribution of the electronic density in a pyridine's ring we can suppose high enough positive charge concentrated in the a- position activates and strengthens its acid character. That is why, oxidation is much probable at methyl-group and lowering of the oxidiser-ion's concentration is the effect of it.

Forming 5-vinyl-2-picoline acid probably exerts suppressed action on Nitrobakter and Nitrozomonas bacteria, which are responsible for the oxidation's processes of ammonia and nitrous acid. The exactly contrary nature in changing of the concentration of ammonia-ions in comparison with nitrate-ions shows in favour of the above- stated suppositions.

Sufficiently complicated procedure of MVP influence on the content of nitrite-ion can be put down to the reduction-oxidation duality of this ion. The concentration of 0,0001 mg\l is recommended as the MVP maximum allowable concentration.

The analysis of the concentration's changing of nitrate-ion in presence of bipheran's different quantities shows this substance exerts stimulated influence on Nitrobacter bacteria. It is confirmed by the contrary nature of nitrite-ion content's changing in the sema solutions. The appropriateness of ammonia-ion consideration's changing depending on the content of bipheran in the investigated medium is non-standard. It tells about an existence of bipheran's optimum concentrations which suppresses action of the Nitrozomonas bacteria (0,001-0,01 mg\l) From the fifth day of the investigation and at the end of it the general tendency of the lowering of the ammonia-ion content and its approaching to the control solution are the consequence of the display of the function of bipheran's regulating component. Probably this component is bipheran's acid part (a-chlor-ethyl), while the stimulated component is its benz-imidazole part.

Difficult enough picture of the dynamics of the nitrificational equilibrium in the solutions with different content of LPS is explained as the following: LPS hydrolyses in the water medium with removal of the ion-equilibrium to the field of less pH- values, rising the concentration of ammonia-ion is its consequence, which leads to strengthening of the oxidising processes under the influence of Nitrobacter bacteria. It leads to sharp growth of the nitrite-ion and nitrate-ion concentration.

Up to the 20th day of the research lowering both the most oxidiser and the most reduced nitrogen forms take place, while the concentration of its intermediate form is maximum. Probably that is explained by the establishment of the equilibrium of the reduction-oxidation processes in investigated solutions. However the sharp deviations in the content of the different nitrogen forms in these solutions from the control solution during the first twenty days can lead to unhealthy influence on the hydrosphere and its inhabitants. That is why the LPS maximum allowable concentration is recommended as 0,001 mg\l.

OPTIMIZATION IMPLEMENTATION FOR EFFECTIVE WATER USE IN UZBEKISTAN

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Effective water use strategy in Aral sea basin connected with Water Sector development at these countries. It is include water management development, institutional development and specialists training. The main directions of water management development are: implementation of economical mechanisms and joint managing of surface and ground water.

On this base we've elaborated water use planning optimization model for a river basin, the task reduced to a task of linear programming. The model was used for a water economical system of Fergana oblast.

There was considered three types of optimization functions: minimum of total expenditures in water distribution for water consumers; maximum of total incomes in water consumers; minimum of integrated significant that account water price, payment for water pollution and a damage from water ensuring of consumers. Results of they implementation presented.

Minimization total expenditures may be used in conditions when we have deficit investment in water economics, that typically for present. But it way gives equal rights to consumers and it is not account water use effect in concrete district, for example soil fertility. That is why this function gives results with low effect for water economics.

Using of total incomes function led to exceeding of the water sector effect, because getting of total incomes connected with use of many types of resources such as water, soil fertility, labour and other. Therefore benefits was got from use of many resources, but we connected it only with water. That is why this way leads to a ground of expensive capital constructions.

Better results was got in third variant. Results of this function use for Fergana oblast water management optimization presented. Fergana oblast

water economics consist from district's institutions of irrigation system and interdistrict institutions and Main Fergana irrigation canal management, that takes water from interstate sources.

In the oblast there are Karkidon water reservoir, six ground water deposits, some small rivers such as Soh, Isfara, Shahimardan: withdrawal water from interstate's rivers with main canals.

Results of water use optimization showed that was deficit between means that receive water sector institutions now and the function optimal significance. The deficit connected with effective water use and distribution and degreasing of unproductive part of evaporation. In addition there was expensive for farms pay for water use. This payment mounted to 30 percent from they total profits. This deficit may be overcomes through rising of farmsincomes and institutional development and training specialist in water sector.

THE IMPROVING OF THE ECOLOGIC CONDITIONS OF THE SMALL WATERCOURSES BY USING OF THE DAM-AERATION DEVICES

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The basic part of the requirements if water of the national economic objects is provided by the basins of large and middle rivers, their conditions depend upon the small rivers, which are greatly influenced by the water management activity at the watershed. The sewage discharge into the rivers and the surface and underground water diversion increase coursed the changes in small rivers not only of hydrochemistry, but in hydrological and sanitary-hygienical regimes as well. The ecological system conditions changed for the word: the rivers tend to shallow, silting, overgrown with aquatic plants; the biological species of flora and fauna were changed.

In this case the actions to ensure the rational use of water resources are needed to do. The existing ways of improving of the watercourses have such a shortage as high energetic capacity. To remove this shortage and to solve some problems is possible with the help of hydraulic methods.

One of the problems is that the small rivers don't cope with the conversion of coming pollutions, and their ability to selfpurifing practically reached the limit.

We designed the dam-aeration devices, for water level rising in the low water period. These devices don't create obstacles to flood passing, and at the same time they promote saturation of the watercourse with oxygen by the special aeration devices and formation of the excessive kinematic energy in the downstream. It improves the selfpurifing processes of watercourses.

The experimental researches on the modes, close to scale were, done for the substantiation of basic parameters of the device. We determined: the efficiency of flow rate depending on angle of slope of the weir; the concentration of the air and speed in different points of the downstream, on the base of which the recommendations on increasing air-concentration in the stream were developed.

Experimental dam-aeration devices were installed in 1992-1994 in Azovskiy district of Rostov region. It is planned to build two devices of this kind on discharge systems in 1996.

THE ALTERATION REGULARITIES OF STATISTICAL CHARACTERISTICS OF BED FORM IN NONSTATIONARY FLOWS OF VARIOUS INTENSITY

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The destinctive feature of streamflow is its occurance within deformed boundaries. As a result of interaction between the flow and channel, the river bed has undulating (riffle-like) movable topography. The experiments on a hydraulic model with movable bed were carried out in the Moscow Land Reclamation Institute in order to study the dynamics of bottom topography and its structure under conditions of nonstationary regime of water movement. Use was made of experimental hydraulic flume with rectangular cross section, 20 m length, 1.0 m width, and 0.6 m height glass walls. Sand of the Dmitrov quarry, with average particle diameter 0.2mm and density 2,65 g/cm^3, was used as loose medium.

When studying bottom topography structure, the nonstationary regime of watermovement was modoled in the form of multistaged and triangular hydrographs with intermittent and continuous change of water discharge. For different tests at rise and recession of modeled hydrographs, V=0/21-0/60 m/s, $Re=VH/\upsilon=2.99\times10^4$, $Fr=V^2/gH=0/031-0/235$, $\Delta_q/\Delta_t=0.26\times10^{-5}-11.67\times10^{-5}$ m^2/s^2, where V and H is average flow velocity and flow depth, respectively; Re is Revnolds number; Fr is Froude number; Δ_q/Δ_t is the intensity of alteration of specific discharge of water; g is free-fall acceleration; and υ is kinematic viscosity.

The following parameters of bed analysis height h, length λ, length of upper slope λ_u, slope ratio δ, uper slope ratio δ_u, and bottom elevations.

The results of data processing show that the normal values and dispersion of bed form parameters and bottom elevations are directly proportional to mathematical expectation and depend on the peak of hydrograph and its intensity. Both at the rise and recessoin of hydrograph, the dispersion of parameters of bed forms is reduces with an increase of intensity of water discharge alteration. The parameters of bed forms under stationary flow have largest dispertion. The values of dispersion are smaller by 10-80 % for nonstationary flows.

We have determined coefficients of variation c_v for 320 data files. Data analysis shows that during the rise of hydrograpf, c_v^h slighly depends on change of velocity and specific water discharge, although the tendency of direct proportion exists and is independent of the intensity of alteration of specigic water discharge. The general tendency of grouth of c_v^h with an increase of q is observed. In this case. the coefficients of paired correlation r of relation $c_v^\lambda=f(q)$ are aqual to 0.59-0.92.

In most cases, positive asymmetry tyoical for distribution of parameters of bed form. During the rise of hydrograpf, c_s^h=-0.68-1.28 and is unambiguously independant of q. There is slight tendency of reduction of c_s^h under the recession of hydrograph with decreasing of q (r=0.38-0.66, c_s^h=0.05-1.38).

During the rise of hydrograph, irrespective of its intensity, the excess of heights of bed forms is inverselyproportional to the value of specific water discharge [r=(-0.20)-(0.89)], whichcan be explained by the enlargement of riffles, their lagging, and expansion of the range of sizes. Under the stationary flows, when bottom topography corresponds to hydraulic characteristics, such regularity is virtually not manifested.

THE METHOD FOR ESTIMATING HYDRAULIC ROUGHNESS COEFFICIENT IN VEGETATED OPEN CHANNEL FLOW

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One of the most complex problems of solving the internal problem of the movement of water is a calculation of the hydraulic resistances. At the current level of knowledge about hydraulic resistances, they are taken into account by introducing into the mathematical relations empirical coefficients of roughness n or friction λ. In the present work an attempt is made to develop the general structure of a semiempirical formula for calculation of the roughness coefficient in vegetated open channel flow both in on-site ground investigations and with the use of remote-sensing aerial and satellite photographic methods.

The roughness coefficient in vegetated open channel flow is calculated by the formula

$$n_p = n_0 \sqrt{1+\frac{K_2 h^{1/3}\sum_{i=1}^{m} C_d K_1 K_3 N_{50}\omega_{ib}}{2gn_0^2}}$$

where h is the mean depth of water; no is the roughness coefficient of the bottom without vegetation; N_{50} is the number of plants per 1 meter of width of the flow for a 50% coverage; ω_{is} is the average midsection area of the submerged part of plants of the i-th species; C_d is the coefficient of resistance of flow past the plant; K_1 is the coefficient of density of the vegetation cover characterizing the number of plants per 1 m of the width of the flow for a coverage other than 50%; K_2 is the coefficient of the species inhomogeneity of the vegetation cover characterizing the presence of plants having a different effect on the velocity structure of the flow on a selected homogeneous stretch; K_3 is the coefficient characterizing the blanketing effect; g is the acceleration of gravity; under the summation sign are quantities belonging to the i-th species of higher aquatic vegetation.

The following methods of determining the roughness coefficient in vegetated open channel flow is suggested for remote-sensing methods of investigation as simpler but less accurate ones.

Stretches where a species or group of species of vegetation dominates are singled out on the aerial or satellite photographs and the coverage is determined for them.

Depending on the species of vegetation, the number of plants N_{50} per 1 m of the width of the flow and the coefficient of resistance of flow past the plants C_d are established from table. The coefficient K_1 is used for converting to values of N with another coverage.

The values of the coefficients K_2 and K_3 are determined from tables. Intermediate values of the coefficients are determined by linear interpolation. For a homogeneous vegetation cover (dense reed beds) it is considered that K_2=1.

Having taken the mean water depth h equal to the most frequently occurring growing depth of the plants, we determine the midsection area of the i-th species from the functional relations $\omega_{is}=f(h)$. The coefficient of granular roughness of the bottom without vegetation is taken for conditions with analogous soils.

The given method is for the most part the same when determining the roughness coefficient in vegetated open channel flow from data of on-site ground measurements.

ESTIMATION OF THE ADMISSIBLE LEVEL OF PESTICIDE POLLUTION IN WATERBODIES WITH COMMERCIAL FISHERIES BASED ON THE TOXICOMETRIC APPROACH

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The use of pesticides in agriculture inevitably involves pollution of soil and water, however, no effective alternatives are so far available that could replace the chemical protection means so that the norm setting for toxic effects still remains an effective problem. The material of toxicological studies accumulated up to now and concerning the maximum admissible concentrations (MAC) for the fisheries has made it possible to go over to broader quantitative generalizations.

The studies in question included the following work: analysis of the conjugation of the toxic characteristics of substances under investigation, kinetics of acute and chronic experiments, the functional description of experimental results and the study of quantitative regularities. The quantitative generalizations serve as a basis for the development of express methods for the norm setting to pesticides. It is necessary to find an optimum complex of indices (predictors) that would allow one to carry out with sufficient reliability on the basis of express methods the norm setting for pollutants in waterbodies with commercial fisheries.

The calculation method for determining admissible (assumed as safe) levels of pollution rests on the hypothesis that there exists an objective relationship between the results of acute experiments, i.e. using average lethal concentration of pesticides killing 50% of the experimental animals (LC_{50}) and the maximal concentrations in water which do not have a determinal effect on the populations and organisms(MAC). The use of the calculation method makes it possible to obtain MAC express estimates for the pesticides which have not been used before; the laboratory determination of these values using the complete programm is cumbersome and time-consuming. We have conducted a statistical analysis of toxicometric data for over 30 pesticides for the following parameters: LC_{50} for fish, fry and daphnia, molecular weight, temperature of boiling and melting, the degree of lipophility (given by the distribution coefficient in the system "octanol-water"). This analysis has revealed the structure of correlations and shownthe main quantitative regulatities.

One part of the body of data (we mean here 54 preparations for which most characteristics in question had been known) were used to construct approximate prognostic formulas, while the rest of the data served the purpose of the correlation analysis and control.

The physico-chemical characteristics examined have not indicated unambiguous quantitative relations with the toxicity of the preparations. Even so it seems probable that the knowledge of the specificities in the chemical structure and properties of the pesticides may be used for prognostic purposes. The analysis of the data obtained indicates also that the characteristics most important for the estimation of the pesticide toxicity are the toxicometric data (LC_{50} for daphnia, fry and fish) and the distribution coefficient "octanol-water"(K_w).

The statistical regularities revealed have served as a basis for working out methodical recommendations as to the application of the method for calculating the safe level of pesticide effect in regard to the waterbodies with commercial fisheries.

THE COMPLEX ECOLOGICAL PROGRAM "IMPROVING OF THE ANGARA RIVER CONDITION"

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The Angara river is one of the largest waterways of the Irkutsk region. Its length is 1059 km.; the region's key industrial centers such as Irkutsk, Angarsk, Cheremhovo, Bratsk, Ust-Ilimsk are located on the river watershed territory.

The complex evaluation of the Angarsk region air and water basin's condition has been carried on. It is aimed to working out the special program to improve the Angara watershed condition.

The industrial sewage is produced by the key regional and Russia's petrochemical, lumber and paper processing, aluminium processing, microbiological industries' operations. the main sources of the Angara watershed pollutants.

Petrochemical production, suspended substances. phenols, organic matters, heavy metals, substances containing nitrogen "gained" the priority as the basic air and water pollutants.

Judging by the volume of sewage produced, the Angara watershed shares the tenth place among all the largest rivers in Russia; and approximately 90 percent of non- or badly purified effluents cause the constant air and water pollution in our region.

The annual volume of the Angara water effluents is 1544 mln.m^3. The sewage flows carry also 13.2 th. tons of suspended substances; 14.4 th. tons of organic matters (by BPK), 748 th. tons of sulphates, 748 tons phosphorus, 3300 tons of ammonium nitrogen, 210 tons of oil products, 4.9 tons of phenols.

The largest volume of sewage - 31 percent - is produced by timber processing, lumber and paper processing industries. The petrochemical and chemical industries' total "contribution" to air and water pollution is 26.5 percent of effluents; power engineering economy produces 18 percent of effluents, and our municipal economy, relatively, - 14.5 percent.

As a negative result of the economies' antrophological activities, the quality of th Angara water does not meet the GOST's standards required over the whole river's length below Irkutsk.

Among the most badly polluted cities of R.F. (41), there are five of those in the Angara watershed. They are Angarsk, Bratsk, Irkutsk, Usolue-Sibirskoye, Shelehov where more than half of the Irkutsk region's population lives. Due to the estimated results of the region's ecological situation, the average annual concentrations exceed the sanitary standards on content of dust, dioxide nitrogen, carbon bisulphide, pholmardigide, metilmerkampan, bensopiren. In total, over 1 mln. tons of pollutants of more than 100 designations known are waster in the region's atmosphere.

Transportation, chemical and petrochemical, lumber and paper processing, non-ferrous metallurgy, heat- and power engineering industries have the most destructive impact on the environmentally impacted Siberian areas.

Along with the thorough analysis of the Angara watershed pollution, the analysis of the priority industries has been conducted. It serves as a basis for working out a complex program "Improving of the Angara River Condition" which strategically focuses on modernization and reequipment of the plants-pollutants. Also, the entire program is targeted on use of specific measures to solve environmental-health policy and ecological education problems.

MODERN CONDITION OF THE RIVERS IN THE KOMI REPUBLIC

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The estimation of rivers Water quality hase been made. The system of limiting tolerable pollutants concentration was used as a criterion of water condition. The main data resulted from long term observations by the Institute of Biology and by Sevhydromet on 20 rivers in 34 points.

It was determined that water quality in separate parts of the main rivers in Komi Republic (Pechora, Vychegda) had changed and now belongs to III and IY category. The tributories of the Pechora river (Vorkuta, Bolshaya Inta, Kolva, Ukhta) have the highest water pollution degree. In this regione are located many coal and oil industry facilities. Ammonium nitrogen, oil products, iron, phenols, copper are the most widely spread and stable pollutants. The Mezen Bassin rivers have the highesr category of water quality. The intensive deforrestation is the main factor that influences chemical balances of water.

The regional water pollution map of Komi Republic rivers has been made. Some rivers werw classified conditionally taking into account the absence of pollution sources. They belong to category of relatively clean water. The conditionally clean tributories have the large significance in purification of main rivers.

ECOTOXICOLOGICAL CHARACTERIZATION OF 1,1' - DIMETHYLHYDRAZINE BIODEGRADATION

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1,1' - dimethylhydrazine is a first-class hazardous component of the propellant. Since the process of biodegradation of this highly toxic component is still poorly known, the environmental safety of this process becomes the first priority.

Biodegradation of 1,1' - dimethylhydrazine was ecotoxicologically characterized. Biotesting of water solutions supplemented with 1,1' - dimethylhydrazine and its biotransformation products was used in this study. As a result total toxicity of all its derivatives was assessed.

Escherichia sp. culture (yield test) as well as wheat and barley seedlings cultured in water and soil

systems (phytotoxicity test) were used as test-objects.

In addition, chemical analysis for dimethylnitrosoamine, the most carcinogenic compound among biotransformation products has been performed.

In order to biodegrade 1,1' - dimethylhydrazine in water environment, Candida sp. culture, one of the most degrading microorganism was used. It has been shown that biodegradation significantly decreased its content (by 70-80 %) and integral toxicity of a cell-free culture liquid determined by biotesting.

Residual content of dimethylnitrosoamine in biotransformation products was insignificant, less than 2 % of its residual content of.

Data obtained prove ecological safe of biodegradation of 1,1' - dimethylhydrazine.

WATER PROBLEMS ON THE EVE OF THE XXI CENTURY

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There is no need to remind once and again about significance of water as the most important component of natural environment, ensuring life of the earth and preserving biosphere. Total fresh water reserves of the Earth are great enough. Summarized mean annual river discharge in the world amounts to 46.8 thous. cu km, the volume of fresh water in lakes is 91 thous. cu km, renewable fresh ground water resources are a bit more than 13 thous. cu km per year. In Russia these meanings are following: river discharge amounts to 4.3 thous. cu km per year, lakes give 24.5 thous. cu km correspondingly; potential groundwater safe yield is about 230 cu km, among them 27.3 cu km are diluted and 14 cu km are pumped out. If it is considered that total water consumption in the world at the beginning of the 90-th was 3,300 cu km per year, and by forecast it will reach maximum 5000 - 5,300 cu km per year by the 2 000 year, then it would be impossible to speak about water deficit as in the world dependable water supply for a person is 22 cu km per day in the middle of the 90-s. However, irregularity of water resources distribution and different intensity of their use, depending on the level of econimic potential in some regions (Central Asia, the Southern Urals, the Northern Caucasus, some states in the USA, North-Chinese plain etc.) contributed to producing a tense situation and in some cases even cause ecological catastrophes. Deterioration of water quality is observed almost everywhere. Many water object, including groundwater sources, do not correspond to standards, particularly high standards should exist for potable water quality. Water environment state is much determined by the level of civilization. For the last 20 years developed countries have spent a considerable portion of their national income for improving natural environment that partially helped to improve the ecological situation. It is not the same in developing countries and, unfortunately, in some countries-former members of the Council for Economic Mutual Assistance. Further man-induced impact on the environment and climate changes will undoubtedly affect water resources and heir quality. Thus, climate warming up can cause a considerable change of water content and river discharge regime on a global scale; steppe zone drying up will occur; thawing processes in the permafrost zone will activize etc. The International Decade for Drinking Water Supply and Sanitary has come to the end, however, there is no radical solution of these problems. The World Conference in Rio-de Janeiro in 1992 has announced the strategy of "stable development". Perhaps, it will become a turning point in the problem of biosphere protection.In the paper the analysis of the present situation, reasons for water resources deterioration and depletion will be given and ways of improving the situation will be suggested. Special attention will be paid to the nature-protecting policy in Russia at a present stage, when, as a rule, the laws of the former USSR are not valid and new laws are not all formulated and approved. Under these radical nihilism conditions, the measures are often put into practice, producing inadmissible negative effect on natural and, particularly, water environment. The Concept of rational water use will be formulated basing economical, balanced use of natural-resources and energy-saving technologies, not depleting and not polluting the environment. This Concept can become an integral part of the strategy for Russia transition to the stable development model.

CHARACTERISTICS OF IVANKOVO RESERVOIR HYDRAULIC AND HYDROCHEMICAL PARAMETERS

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Methods of field research work are particularly important for researching processes within a water reservoir. In this work attention is paid to hydraulic and hydrochemical parameters of transit flow in Ivankovo reservoir.

Ivankovo reservoir is the main drinking water source for Moscow. The water collecting area is 41,000 square kilometers, the reservoir itself covers 337 square kilometers, it is 127 kilometers long, its maximum volume is 1.12 kilometer cube, its average water replenishing factor is 8.67.

The reservoir hydrodynamic structure is one of the main causes affecting the water quality. During many years, complex monitoring was carried out on Ivankovo reservoir of its hydrological, hydrochemical and hydrobiological regimes. The measurement were taken at nine reaches on the reservoir, embracing eight characteristic areas. All these places have roughly similar morphometric parameters, flow speeds and shallow water areas.

Detailed hydrodynamic research allowed to distinguish the transit flow as hydrodynamic structure inside the reservoir basin. That low is formed by the watercoming from Wolga, Tvertsa and T'ma rivers. It retains its structure even when the reservoir is filled up to its maximum capacity. The transit flow parameters (live cross section area and reach mean speed) are varying along the reservoir. However, the flow retains its structure from the inlet reach down to the dam.

Under steady regime and with the wind not too strong, the speed field in Ivankovo reservoir is determined by the flow through the dam. The supply from aside is not very significant (<10 %), so it is possible to consider the flow equal for all reaches along the reservoir. At the same time, the flow speed is decreasing steadily from the inlet to the dam.

The speed measurement in the reaches allowed to select a function U=f(x,Q), where x is the distance along the fairway from the outlet reach, and Q is the flow throught the dam.

Simultaneously with hydraulic measurements in the reaches, the temperature and 12 hydrohemical indexes are measured. The distribution of nitrogen and phosphorus along the reservoir, electric conductivity and permanganate oxidizing show clear self-purification trend. That trend is broken below the place where Donkhovka river flows into the reservoirs. That river collect huge amount of agricultural waste from 158 square kilometers, and urban waste from Konakovo town with population of 43,000. However, when using fertilizers dropped down dramatically, concentration jump of nitrogen and phosphorous below Donkhovka river mouth decreased to about one-tenth of what it had used to be.

There are no changes of chloride and sulphate concentrations in the reservoir.

We may draw a conclusion that distinct separating of water masses according to their hydraulic and hydrochemical characteristics allows to forecast the processes inside the reservoirs under various influences from outside.

NATURAL ARAL-CASPIY SUBSOIL HYDRO-AUTOMATION (NACSH) AND INHERENT REDISTRIBUTION OF WATER RESOURCES IN THE ARAL-CASPIY REGION (ACR)

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The NACSH activity is externally manifested by numerous asynchronic seas' level fluctuations. It naturally regulates the spontaneous transference of the Aral basin rivers' flow (ABRF) into Caspiy. Multicyclisity of Level regimes (LR) reflects the periodic Caspiy replenishment beats by ABRF, the natural, uncontrollable redistribution of water resources into ACR by alternating subsoil hydrolic cataclysms of two principally different types. The periodicity and duration of Caspiy ABRF replenishment beats is determined by the hydrocataclysm force which depends on the pressure between the seas [1, 2].

The Caspiy ABRF replenishment beats are manifested by counterphases of seas level convergence (CLC), Aral level drop and simultaneous Caspiy level rise, pressure reduction between the seas. These are mainly followed by periods of either total or reduced Caspiy ABRF feed. They are coded by counterrphases of level divergence's (CLD), Aral level rise and simultaneous Caspiy level fall, pressure increase between the water reservoirs (basins). The sequences of CLD and CLC form perennial, supracenturial and multicenturial LR cycles and Caspiy ABRF replenishment. At this low rank cycles overlap high rank ones.

The alternative conception considers "the drying up", the Aral "degradation " of 1961-1993 (approximately) and the Caspiy overflowing" in 1978-1993 to be a stage in the seas evolution, a consequence of a regular natural subsoil macrohydrocataclysm and a very rare CLC 1961-1993 in the history of seas. Simultaneously they terminated current multicenturial, supracenturial, secular and perennial beats of Caspiy ABRF replenishment and LR cycles. Then the water pressure decreased by 18 m from 82 to 64 m.

As a result of the approaching hydrocataclysm at the maximum sea level convergence (in August 1003 it was 63,73 m) another regular germetization of the subterranian Aral (bed) course into Caspiy is expected [3], as well as an abrupt decrease and possibly a stoppage of Caspiy ABRF replenishment. In [1] a description of the principle and NACSH action mechanism is given. "Method of Aral Caspiy seas level regulation, water resources, solutions and forestalling socioecological and contiguous crises seemlier to those in contemporary Aral-Caspiy region" has been officially registered in Ukraine.

The above presented demands immediate revision of stereotype nations, based on them strategies of overcoming socioecological and contiguous crises in ACR; a correction of international technicoscientific and investment billion dollar programs; a

reorganization of scientific research coordinating centers.

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THE WATER AND RESOURCE PROBLEM OF THE ASIAN PART OF RUSSIA

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Water and resources problems (WRP) are contradictory circumstances, appearing during the usage of water resources, as a result of deficiency of data about conditions of resources and because there are objective contrasts between branches-water users, water using and environment and also because of erroneous actions within water management. WRP is to be subjected to revealation, study and solution; and the solution may be both complete (removal of problem) and partial which leads to decrease of acuteness of problem.

The list of WRP of Asian part of Russia, which is united in 5 groups: the degree of study, water supply, influence organization of water use was determine. For this area the new WRP-classification was made: regions are distinguished by relative community of WRP-circumstances, which are determined by nature zone-nonzone conditions, extensive conformity of forming and conditions of water resources on one hand, and economical development of area on other hand. The limits of regions was pointed out in order to drainage-basin principle.

On the area of Siberia and Far East 19 WRP-regions, ranged with the help of balls marks according to the acuteness of WRP were distinguished. In result of integral appreciations 4 types of WRP-situations: extreme (Tobol-Irtishskiy and Amursko-Primorskiy regions), crisis (6 regions), faint acutness (8), relatively happy (3) were distinguished. The map-scheme of structure of influence of branches of economy on the water resources, water-ecological situation, WRP-classification were made. The analyse allowed to determine the superiority of steps for optimization of water use in conductions of aggravation of economic and ecological crisis, increase of international and interregional contradiction for regions.

EVALUATION OF CHANGES IN THE FUNCTIONAL STATE OF THE AZOV SEA FISHES IN THE PRESENT CONDITIONS OF HABITATION

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The functional state of sturgeons, which are the most valuable component of the Azov Sea ichthyofauna, has been studied under conditions of the changing ecological situation since 1978. Genetic, biochemical, physiological and hystological methods have been employed for this purpose.

It has been found that the artificial reproduction whereby over 80 % of the present-day sturgeon populations were obtained did not disturb their genetic structure and diversity.

The observations of their reproductive system did not reveal changes in the rate and periodicity of the maturation of sturgeon and starred sturgeon as compared with the previous years when "natural" generations were predominant.

On the other hand, over the last years the process of gametogenesis of sturgeons in the marine and fluvial periods of their life was increasingly disturbed. During the marine periods the anomalies have been revealed which were caused by the delay in the development of gonads at the I-II stages of maturity at the age of 13-16 years, by weakening of the reproduction function, total resorption, change in the fecundity, cystoid regeneration of gonads, degeneration of young sex cells, asynchronicity of the cells development and hyperemia (degeneration) of testes. The frequency of anomalies observed in the sea amounted to 20% in total.

In 1995 in the sea during spring time and at the end of their migration period, 17 % of females at the IV stage of gonad maturation exhibited the first signs of resorption of sexual cells and various disturbances of hormonal metabolism: the concentration of the gonadal hormone estradiol decreased 7 times in blood while the content of water in eggs increased, the concentration of testosterone lowered 3 times against the background of the "normal" level of estradiol.

The frequency of the degeneration of ripened eggs and milt increased from 6 % in 1978 to 20-10 % in 1994 and 1995, the samples were taken at different sites of the migration route. These anomalies of the ripened genital glands affect negatively the results of artificial reproduction of sturgeons.

There are some data indicating that a part of the spawning stock of sturgeons remain in the sea because of disturbances of hormonal metabolism.

Deviations of biochemical parameters (the content of cytochromes P_{450} AND b_5, vitamins A and E, gonadal hormones and other indices) have been observed pointing to chronic intoxication processes of sturgeons in natural populations over the last years.

A "functional" cumulation of negative biochemical shifts affecting the physiological state, generative features and behavior of sturgeons manifested itself in 60, 20 and 30 % of females and males of sturgeon spawning population in 1993, 1994 and 1995, res.

These changes bear witness to the effect of pollutants and other manifestations of human activities on the development, the growth of gonads and as well as on the migrational and spawning behavior of sturgeons.

SMALL RIVERS AND RESERVOIRS: PROBLEMS OF INVESTIGATION, UTILISATION AND PRESERVATION

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A considerable part of population in Russia and other countries is concentrated on the banks of small rivers and reservoirs. Small rivers bring weighty contribution to the water resources developing of medium and large rivers and in many respects determine their ecological condition. Meanwhile, the existing knowledge of small rivers and reservoirs is evidently insufficient and this is mainly because it is impossible to arrange a gauging station at every water object. Hence, such items as typological approaches, division into districts according to the peculiarities in formation and functioning of water resources of small rivers and reservoirs, according to the common character of the ways of effective, ecologically safe utilisation and preservation are of special urgency.

Under the conditions of Russia and especially Russian plain it is highly promising to implement typology and to district the territory on zonal-landscape foundation.

A map of surface flow from rural and forest lands for agricultural regions of Russia is plotted, it shows those anthropogenic, often non-uniform changes, that the flow suffers.

Among the most urgent problems, concerning the formation of water resources of small rivers and reservoirs, - catchment contribution and transformation of runoff on its way from slopes to outlet. It is revealed, that in forest and steppe zones hydrological processes in the basins of small rivers and reservoirs differ in essence. In the forest zone the runoff contribution of infiltration origin to the water resources is great, while in the steppe zone its participation is essentially lower. On the contrary, in the steppe zone the quota of surface flow from slopes and territory of drainage network increases. In the steppe zone in comparison with the forest zone hydrological role of closed negative forms of relief and separate seats of underground waters alimentation is sharply increases. Trends and effectiveness of nature and water preservation measures correspondingly change.

The environmental assessment of small rivers and reservoirs is one of the pressing challenges. Among promising approaches to its solving - search of indirect indices of anthropogenic pressure. The authors plotted a map of general anthropogenic pressure on local water resources on the territory of Russia, it revealed as a whole zonal-landscape picture of such pressure, interrupted in the regions of city agglomerations.

In general on the considerable part of the territory of Russia the ecological condition of small rivers and reservoirs is unsatisfactory. They are polluted and their water regime is upset.

Conception of small rivers and reservoirs problem solution must be based on preventive principles. The main thing is to avoid the most negative changes of the water element of the environment. The following measures are in the number of the most urgent: to district the territory; to basis the most effective network of small rivers and reservoirs monitoring in the singled out regions; to revise the character of catchment territory land-use, taking into account possible influence on water resources.

A weighty factor for the improvement of water resources condition could become a system of measures aimed to regulate runoff, beginning from slopes and ending by ponds and small reservoirs, at the same time developing small hydropower.

It is impossible to settle the problem of small rivers and reservoirs without broad public participation both in gathering the information and data and in the discussion of different aspects of this challenge.

GALOGEOCHEMICAL CHANGES IN THE VEGETATION AND SOILS IN THE AMUDARIA DELTA UNDER THE CONDITIONS OF ARIDIZATION

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In the connection with the water-level fall in the Aral see, caused by increased water consumption for the needs of watering and by taking away of waters from the Amudaria and Syrdaria, vast dried territories with various state of soils salinisation formed on the bands and in the Amudaria delta. In the Amudaria delta in 60-ies one could observe quick interrelated processes of surfacewaters transformations, replacement of hydromorphic soils by semigydromorphic and automorphic, death of glycophyle, riparian and tugai species and communities.

To the 80-ies there formed comparatively stable saptial landscape structure of this territory, that reflected the end of deltas drying up in connection with the waterfall of the Aral sea and reduction of the Amudaria flow.

Tugai communities on the natural levees of the main stream remain in the poor state, on the natural levees of the secondary streams they parished, but had not been substituted by formed community of desert type. The pause in the overgrowing of the slopes of the natural levees can be mentioned. On the interstream depressions the communities of halophyle type with insignificant changes in their species composition preserved.

In the process of desertification the changes in the galogeochemical background of the deltaic landscape is observed. During the period of studies the content of chlorine, calcium and magnesium ions increased essentially in the upper soil horizons. On the natural levees in the desertified alluvial-meadow-tugay soils the content os salt increased in the upper horizons (10-20j cm) by 2-4 times, but the surface crust its unsalted. In the peat soils the salt content is high along the whole profuse.

Irrigational activities on the territory of the modern delta (channels construction, river banks construction, liman watering, construction of basins-collectors of drainage flow) promote to the additional input of chlorides into the soil and formation of solonchaks.

Changes in the salt composition in the root layer of soil (0-50 cm) is reflected in the changes in salt composition of the surface organs of plants. Desertifying natural complexes of interstream depressions gradually transformed on the most part of the territory into the meadow-solonchak, that is manifested in the changes in their species composition a well as in the macroelements composition of the most species of the plants.

THE WATER ECOLOGICAL SYSTEMS STABILITY IN STEPPE ZONE

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Forming of the water ecological systems in steppe Zone.

The intensive water resources usage for irrigation, increasing antropogical influence on the small and middle rivers and unsatisfactory management of irrigation systems have resulted in negative ecological consequences - landflooding and salinizating of agricultural land, degradation and loss of the economical meaning some water ecological systems.

Water ecological systems are complicated multi-unit systems forming agricultural landscapes are remarkable for their climatic, hydrogeological and biologic peculiarities. With the aim of science based approach to the steady estimate of water ecological system it is necessary to find out the main reasons of it's ecological breaches and to work out the system of the measure to eliminate ones or to minimize one's influence functionizing of the ecological system as a nature object.

Water ecological systems in Steppe Zone (irrigation systems and basins of small and middle rivers of the North Caucuses and Volga area) are characterized by some common dependencies. It could be considered as a nature objects combining with landscape where all natural components are connected and are remarkable for some ecological breaches resistance.

The main reasons of ecological breaches could be attributed: large canal loss and seepage loss, surplus irrigation rates, raising of groundwater level, bad water-saline regime, lack of the collector-drain water purification system.

The main reasons of the ecological breaches of small rivers are the decreasing of water volume, intensive oversilting and overgrowing of river beds, pollution and deterioration of water quality, colmatage of underground water sources and decrease general channel drainage, ect.

Water ecological systems of irrigation systems and small rivers could be presented as unrestored systems without reserving with consecutive united elements. Each element of the system describes determined condition of component part of the ecological system. It is possible, there are connections between elements of the system. These connections will be considered independent.

It could be find resistance of water ecological system with the help of the probable model by the known characteristics to generalize external influences and resistance to these influences.

Criterions and basic indices of water ecological system resistance could be formulated from analysis of conditions estimations, used this time, efficacy and reliability one's compounds elements.

General criterions of water ecological systems resistance and reliability are level of water in a channel or hydraulics efficacy of channel velocity, water quality, raising of underground water level on the area possibility to provide ecological reliability. Complex of this criterions characterized essential conditions of resistance and ecological reliability of water ecological systems. Such conditions should provide ecological balance of water ecological systems.

Estimation of the resistance rate and reliability rate for water ecological systems was carried out accourding the dates obtained on the Bagaevskaya-Sadkovskaya irrigation system and the small rivers Grushevka and Tuzlov of Rostov region.

PROBLEMS OF SETTLEMENT PROTECTION AGAINST RISING CASPIAN SEA LEVEL

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1. Recent 10 years the Caspian Sea level for various reasons went up. After it reaches the mark -25 m the considerable areas of settlements in the Caspean region will become damp-boarded island almost all the year laying below the level of surrounding water. Flooding and rising water levels, traditional sewage accumulation in pits and no water purification for water supply will bring various pollutants and bacteria from sewage via groundwater to water supply.

2. Construction of large scale preventive systems will involve much water in purification and further waste utilization. Run-off problem requires the development of new techniques for drainage and drainage water utilization.

3. Only 5 of 40 settlements within the Caspian -26.5 m mark impact region have local sewage networks and purification facilities. Recommended are the proper techniques of water processing for the settlements.

4. There are known water purification systems designed for additional water treatment. However, their application in the Volga delta region is limited by wide range of initial water quality, various schemes of water supply, etc. That is why the serial water purification systems are to be tested and modified for specific site conditions. Investment shortage may be overcome.

5. Activity of surface and ground waters in the Volga delta region created the unique situation. In the shortest time the feasibility, design and construction programme has to be implemented for ove 5,000 ha area. The numerical model will be developed for the environmental monitoring and forecasting the situation. The model will be based on the database including the field data accumulated by "AstrakhanGiproVodKhoz" Joint-Stock Company. The forecasts will be done using MODFLOW. The software was modified for protection against the rising water level in the RF State Scientific Centre "VODGEO".

THE NEW ESTIMATION TECHNIQUE FOR RISING GROUNWATER LEVELS AND DRAINAGE

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Groundwater levels tend to rise on urban lands due to water losses during construction and management of civil and industrial facilities. The drainage systems protecting against rising water levels are to be accompanied by monitoring networks. Geostatistics provides the mathematical tools for optimization of their design. The approach is based on geostatistical study of variability of depth to water table over the area and in time.

Optimization inclides three kinds of quantitative criteria: hydrological, geostatistical and economical. Optimization is checking the possible alternatives of the network design with the listted criteria under various modeled failures of pumping wells.

Variance of estimated depth to water table is the geostatistical criteria calculated by kriging.

The depth to level mapping precision can be calculated for every network design alternative to make the better choice fitting the cost-effectiveness criteria.

To improve the precision of water table monitoring within areas adjacent to drains the new calculation technique has been developed.

It allows to avoid mistakes resulted from known techniques for partial drains when calculations consider zones comparable in width withup to 2-3 thicknesses of the drained aquifer.

The developed optimization and estimation techniques were applied to several specific sites in Russia and CIS.

ECONOMIC-GEOGRAPHICAL ASPECTS OF WATER MANAGEMENT

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Economico-geographical aspects play a constantly increasing role in water management of any industrially developed country or economically developed region a they reflect the interconnection between elements of natural environment (water resources in this case) and productive forces of society.

In this connection the problem of territory division (no matter how large it is) into economic-geographical areas as far as the water supply is concerned with regard to technico-economic peculiarities of water use by major water consumers at the given territory, as well as the assessment of the negative impact these water consumers produce on the quality of water sources, should be considered as vital and urgent.

As a fundamental principle in the assessment of water supply of a certain territory (river basin) it is supposed to use an approach when not only actual water potential of the territory and volumes of its use will be regarded, but also technico-economic peculiarities of water used by major water consumers, water sources quality, volumes, structure and concentration of sewage water discharged, water use efficiency, structure and peculiarities of economic potential of the territory under consideration, total population, its density and concentration, i.e. the whole spectrum of socio-economic and environmental factors.

The proposed methodological approaches were approbated by the example of a large country with a highly developed economy (the USA), water supply of which was evaluated according to all the positions (characteristics) mentioned above.

The obtained results allow to divide the territory of the country into 4 regional types according to the intensity of water-economic situation:

1. the territory with intensive water-economic balance;
2. the territory with insufficient water supply;
3. the territory with sufficient water supply;
4. the territory with a high level of water supply.

Each type is characterized by certain qualitative and quantitative limits. The use of new methodological approaches at the macro-level allows to assert that 75% of the US territory inhabited by 80% of the total population can be referred to the 1st problem of the development and location of productive forces at these territories becomes rather problematic. Construction of new industrial sites in the areas of the first and second type will require considerable material expenses from the water economic point of view to avoid additional load to the environment in this area which has been under considerable anthropogenic press even nowadays.

The proposed typology and zoning based on this typology allow to take a fresh view on the real water supply of this or that territory and are an important tool in water management.

MODERNIZED MATHEMATICAL METHODS AND COMPUTERS TECHNOLOGY LAWS USED OF CONTROL SUCH WATER RESOURCE SYSTEMS

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Owing to strengthening the loading of antropogen character on river water objects, the problem of control of the efficiency of water resource systems (WRS) in many regions of Russia seriously became more acute. Using mathematical methods, application of high speed computers and sophisticated software, make it possible to increase the efficiency of the WRS control sufficiently [1, 2, 4]. WRS's re complicated natural-technological systems and that is why identically complicated mathematical models and methods are used for their control, including both determinate and stochastic, optimiing, imitational and so on. While realizing these models in computers, calculative methods of solution of differential equations' methods, of theory of probability and mathematical statistics, linear and non linear programming methods, etc. are widely used. In the cases of solution of control problems for WRS of low and middle complexity the application of those models and methods produces good results. In cases of more complicated problems of WRS (large series of water reservoirs, pump stations and so on) and in cases hen data is scarce large quantity of poorly formalized constraints of economical, technological and ecological character etc., the use of such models to use new mathematical models and methods of control such WRS. In our country and in foreign countries now mathematical models and methods are widely used, based on the theory of expert systems and fussy set [3,5].

It is possible to organize more efficient WRS control, using computer-based expert systems and

taking in account individual peculiarities and experience of WRS exploitation for a long period. The rules of control which we have in expert systems onnect the estimate of the controlled object state with a sequence of operations of the "if-else" type, accomplishing indistinct deviling of the space of input data in every local region pont to the succession of control operations. An important role is played by fuzzy systems and set in effective WRS control using expert systems. The basis of traditional models and WRS control methods are mainly water-balance correlations, for which concretely given parameters of water reservoirs flow characteristics, losses etc. are necessary. But these models and methods do not reflect the always present uncertainty of the water-balance characteristics and their human knowledge.

The esearches made by some Russian and western scientists corroborate the large efficiency of the use of the theory of expert systems and fuzzy set in WRS control. Such research was done by Japanese scientists for creating of a computer system for control of a water pump station and for forecasting of water temperature in the water reservoir: for solving the problem of evacuation of population in case of possible flood by US researchers; by Russian scientists for control of operation of a water-complex "Seversky Donets - Donbass" etc. The using of the theory of expert systems and fuzzy set could play an important role in control of the unique by its complexity and scale Volga-river WRS.

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PREPARATION, ACCOUNT AND RATIONAL USE OF WATER IN THE WATER ECONOMY SYSTEM OF UKRAINE

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Recently the following phenomena have noticed in the water economy system of Ukraine: a) rising of the water demand; b) toughening of requirements for treated water quality; c) exhausting of fresh water resources and these active contaminating with sewing waters.

The last decade the water quality has been deteriorated due to effect of negative anthropogenic factors; at the same time poor quality of projects and construction works as well as neglecting of maintenance rules for water - economy structures leads to decrease of purified water quality and increase of its cost.

That's why problems of more efficient purification both of natural and sewing waters, seepage control and rational use of water are urgent and of great water economy importance. Institute of Hydraulic Technique and Land reclamation of UAAS carries out works on the problems mentioned above.

Many surface water sources Ukraine have turned from rivers into the cascade of reservoirs with slow flow. As a result, physical and chemical properties of water in the Dnieper river have greatly changed and they getting worse with every year. Nature of toxic components produced by stagnation and fermentation of algae is not studied completely; however phenols and other toxic metabolites were found among them.

Intensive "blossoming" of water resources results in additional problems at water intake and purifying structures caused by accumulation of phytoplankton up to 200...500 mg/l and more;

Maintenance becomes more difficult, filters clog up, head losses and reagents quantities increase. In such period it becomes necessary to augment dozes of chlorine, coagulants, floculants and others reagents that is bad to formation of chlororganic admixture so-called theehaloidmethanes and other highly toxic chemical compounds harmful for health of people.

As natural waters of the present surface water recourses are in fact sewage water of low concentration, quite new technological processes should be used for their purification. We suggest to use for this

purpose filters-biofilters with the floating filter charge which work on the principle of space combination of the contamination adsorption process, their biochemical oxidation by microorganisms and removing of suspended matters and plankton. Such filters have the following advantages: a) unit price of concentration and maintenance decreases if compared to other technologies and design of structures for water purification; b) flushing pump are excluded; c) maintenance becomes considerably easier; d) preliminary water chlorination is excluded and quality of potable water improves.

Underground water of both Central and Western part of Ukraine contain a large quantity of bicarbonate iron which is sometimes tens times the allowable limits. For agricultural water supply the Institute has developed the deferronigation units assembled in water pressure towers of Rozhnovsky. In such towers the processes of simplified aeration, contact coagulation and filtration take place.

Active part in transforming the bicarbonate iron into the trivalent form and in forming insoluble compounds of ferric hydroxide is played by ferrobacteria accumulated on the contact filter grains surface and participating in water deferronigation by the biological method. The filter is flushed by initial water. Construction and maintenance cost of such units are 2-3 times the ones of other units; maintenance is considerably easier, reliability is higher, filter colmatation with ferroxide is excluded, there is no need in flushing pumps, unit price of electrical power decreases.

Modern irrigation system and collective agricultural water lines are great consumers of water. Water meters are necessary not only for accounting water supply to separate users but for establishing rational working reginies of pump stations and other structures of the system too. Now it is rather difficult to organize water account on large diameter pipes in field. Velocity meters are fabricated with small diameter and ultrasonic meters are complicated and economically inefficient in use. That's why it's expedient to measure water flow in pipes of large diameter with a turbine meter placed on the by-pass line.

Methods of installation of these maters, of choosing a diaphragm, of measuring general water flows are developed at the Institute.

The maintenance staff of water economy system should find and stop seepage and uncontrolled water intake from lines as well as provide efficient working regime of pump stations resulting in minimum unit consumption of electric power.

There was developed at the Institute the method of the pipe line manometric survey with the MTC-712 meter-recorders which by means of soloing back hydraulic task allowed to define places of seepage, unplanned water consumption, surplus and insufficient heads at the rates of the system, hydraulically overloaded and underloaded parts of it.

As a result, working efficiency of a water economy system is analyzed and measures for optimization of such work are planned.

MANY YEAR DYNAMICS OF THE WATER RUN OFF AND SEDIMENT LOAD IN THE RIVER SYSTEMS OF THE WESTERN UKRAIN

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Extensive degradation of the river systems upper units, declination of the surface water quality, worsening of the environmental situation in the small river basins require analysis of the reasons and factors which cause above-mentioned changes, estimation of their intensity, study of the development trends in space and time, forecast of their dynamics, and elaboration of measures aimed to improve hydroecological situation. Such tasks are especially actual for the areas of old development like the Western Ukraine. For the quantitative estimation of the runaff and sediment load changes in the river systems of the Western Ukraine many-year (40-45 years) sets of hydrological observations were analysed. Changes in the period up to 1960-1962 were assumed as a spontaneous background because anthropogenic impact during that time span had no significant influence on the water runoff, sediment load and dissolved matter compared with the background one using coefficients

$$K''_{tr} = \frac{Np}{No} \quad \text{и} \quad K'''_{tr} = \frac{Mp}{Mo},$$

where Np, No - runoff layers of the period under consideration and of the background period; Mp, Mo - runoff moduluses of the same periods. Obtained data permit to determine in the many year runoff and sediment load regime in the rivers of the 3-7th order cyclic ascillations and anthropogenicaly determined growth tendency for the period from the beginniof of 1960th to 1970-80th. For example, in 1963-1970 the sediment load modulses in the West Bog river basin grew up in 1.2-1.5 times in comparison to the background one, while in 1976-1980 and 1981-1985 - in 3-4 times (in spite of channel reservoir construction). The water runoff changed - 4+58%. In the Dnister

upper basin(up tp Sambor) sediment load grew up in 4.1 times and runoff layer-for 81 % in the same period of time. In the basins of the Dnister tributaries sediment load growth index estimates 1.5-4.1 times, and one of the water runoff - 14-20%. In the basins of the Prut tributaries the sediment load modulus grew up in 1.4-2.6 times, and water runoff layer - for 15-20%. In the Tisa basin growth of the sediment load estimates 1.6-3.1 times, while the water runoff increased on 11-16%. The tendency of the sediment load modulus grouth is traced up to 1981-1985. In 1981-1985 and 1986-1990 in some basins sediment load modulus stabilized or even started to decline (the results of the reforestation), while in the other continued to grow. In 1991 - 1995 the cases of the catastrophic floads has become frequenter (especially in Carpathians), and the growth of the sediment load modulus is observed respectively. The main reason is growth of slope forests logging The water runoff layer spared for the formation of the runoff modulus (t/km year) can be an important index of the anthropogenic impact on the sediment and water runoff, if compared with the background one. The reccurence of the water and load runoff modulus oscillations, and the tendency of their anthropogenically caused growth in 1970-80 are determined. It is possible to make more exact regional dependencies between water discharge and sediment load and to improve the accuracy of the forecast.

DYNAMICS OF MINERAL NITROGEN FORMS DURING WINTER LOW WATER IN THE IVANKOVO RESERVOIR

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The Ivankovo reservoir enters in the Volga reservoir system. It was created in 1937. Being one of the main sources of water supply of Moscow it is contiinious controlled. At present scientists have the exceptional opportunity to assess the true influence of the main anthropogenic effects for forming water quality at the background of their abrupt decrease.

We have been dealing with the influence of the agricultural factor: carring out of the biogen elements of fertilizers by groundwater into reservoir in winter. The monitoring has been performed since 1985. The samples were collected in the channel part of the reservoir from depth of 3 m. The average results are shown in Table 1, mgN/l.

Table 1.

Year	1985	1986	1987	1991	1992	1994
$N\text{-}NH_4$	1.19	1.15	0.96	0.56	0.68	0.54
$N\text{-}NO_3$	0.85	0.9	0.82	-	1.30	1.18

The analysis of obtained data showed, that the redistribution of mineral nitrogen forms occurred: the ammonium nitrogen form prevailed by the second half of 80-s(1) and constituted 54-58% from net mineral nitrogen, and by middle of the 90-s the nitrate nitrogen form domines. Its part in the net mineral nitrogen increased from 42-46% up 63-68%. However the content of the net mineral nitrogen declined inappresiably: from 2 mgN/l and 1.78 mgN/l in 1985, 1987 accordingly up to 1.72 mgN/l in 1994. At the same time the average factual application of mineral fertilizers at the reservoir watershed reduced in 5 times, and in some districts in 10 times (2). So our researches confirm the notion, that the main entering of biogen elements of fertilizers takes place during spring flood.

It is very difficult to determine the cause of the prevail nitrogen form redistribution due to eutrophication of the Ivankovo reservoir. It may be as result of the considerable reduction of the waste water discharge, one of the supplies of the ammonium nitrogen form. It can be assumed too, that this is caused by the shallow water organic matter during water releases from the reservoir. Broached problems are needs in more detail investigation.

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AMPHIBIANS AS INDICATORS OF ENVIRONMENTAL POLLUTION

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The presence of almost all species of amphibian in the majority of natural and anthropogenic landscapes of Moscow region is dialed with their high ecological variability. The increase of densities of the most common species in the transformed ecosystems is due to favorable micro climate situation and decreases of predators. The decrease of population densities in anthropogenic complexes with dominating of migrating youngsters can be explained by termination and transforming watering places where breeding is happening, predating adults by dogs, cats, crawls and people and terminating their roe and tadpoles by ducks, rotanes and people. The total isolation of anthropogenic complexes from natural ecosystems, i.e. destroying natural corridors which are connecting them, in common with increasing of people's press leads to disappearing of amphibians. For example, that was how amphibians vanished in Terletsky (up to 1980) and South-Western (up to 1989) parks in Moscow.

The technogenic landscapes pollution by heavy metals leads to accumulating them at all trophical levels. Essential differences in heavy metal accumulation by amphibians are shown up for polluted and unpolluted habits. In agrocenozes the presence of micro elements in bodies and substances is in 2-100 times more than in unpolluted places (Cd, Cu - 1.5-2, Pb - 3-8, Fe, Cr, Zn - 10-100 times), because of the income of elements with fertilizers and poisons. The accumulation of elements occurs mostly in liver, bones, pulmonary and roe.

The highest concentration of heavy metals in amphibian's bodies in Moscow region is marked in Taldomsky region - 3-10 times more than in Zagorsky and Dmitrovsky regions. Perhaps, it is dialed with pollution of Dubna river.

In Prioksko-Terrasny reservate grass frogs are accumulating Cr in liver, bones and pulmonary. The happens because of polluting resevate territory from neighboring plants and agrolandscapes.

Amphibians are participating in heavy metal migration from water ecosystems to neighboring land territories. So, amphibians can be good indicators of local pollution of ecosystems and landscapes.

WORKING OUT OF THE MODEL AND PROGRAMME COMPLEX OF FLOODS' MANAGEMENT IN THE WATER-CATCH AREA ON PERSONAL COMPUTER

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According to the Institute's conception of systematic approach to the planning and realization of anti-flood measures, oriented first of all on the damage prevention and not on the protection of the territory from floods, nowadays we begin to work out the model and programme complex of the floods' management in the water-catch area.

However, one should note that yet it is impossible to create the universal model of maximum water flow management, as the approach to the problem of floods will be individual for each separate water-catch area, though the main parts of different blocks of this problem will be common for any water flood.

Thus, the choice of the most effective measures on prevention or decreasing of the negative influence of maximum river flow, should be based on the fact that the proposed method will be more effective if the damage, caused BY floods, is decreased after its realization, in other words - not he cheapest, but the most preventive. Besides, one should take into account one more positive effect of these anti-flood measures - restoration of the forests, decreasing of the soil erosion, decreasing of the polluted substances , coming into the water bodies, restoration of the channel river flows. The damage estimation should be made, using the whole base of information on the river basin.

We suppose to model different water management situations in the river basin with existing maximum river flood, this modeling will include determination of the possible flood-zone, of the possible damage and of the most effective measures on its prevention.

The estimation of the effectiveness of the proposed measures is made according to the following scheme:

- estimation of the flood height as a result of these measures;
- calculation of the prevented damage, corresponding to the flood height;
- determination of the effectiveness of these measures, which is equal to interrelations between the prevented damage and all the necessary expanses;
- comparison of the different measures on decreasing of the flood height, on decreasing of the damage, caused by the maximum river flow or measures, different in their effectiveness according to the management goals.

WATER QUALITY AND WATER RESOURCES MANAGEMENT

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Water quality and water resources management system acting at all levels of administration is being currently restructured so that it should be consistent with the new economic and political conditions in the Russian Federation. The key issues which must be settled in this period are as follows:

- Acquirement of adequate data on water quality and use;
- Effectiveness of regulatory-legislative system;
- Distribution of responsibilities between administrative and executive institutions;
- Adequacy of the budget allocations to the existing water management problems;
- Adoption of the existing and initiation of the new economic stimuli to abate water bodies pollution and depletion in conditions of water management system decentralisation;
- Improvement of methods and methodologies on estimation of standards of water bodies pollution load;
- Development of essentially new approaches to estimation of water quality standards and objectives;
- Active application of the financial stimuli which encourage investments in the Programs of water quality rehabilitation and conservation.

The need for rehabilitation, modernisation and extension of existing water management infrastructure, particularly water and waste water treatment is evident. However, judging by foreign experience, it is likely to be more cost-effective to concentrate initially on strengthening of existing water quality and water resources management system, introducing new approaches and techniques of management, including economic stimuli, and identify priority projects and programs rather than to allocate tremendous resources to uncertain improvements and expensive infrastructure. It is with this purpose that the Component "Water Quality and Water Resources Management" is being developed.

The Component Concept has been developed by the group of water specialists from various regions of the Russian Federation and approved by the Water Management Committee. In accordance with the ultimate objective water quality and water resources management system is to insure:

- Adequate evaluation of water management situation in the region through environmental and health risk assessment;
- Analysis of the alternative trends of the basin (regional) environmental and economic policies as well as needs of restructuring of the production and consumption to provide industries and population with safe drinking water, water conservation and rehabilitation (quantity and quality);
- Integrated water monitoring system;
- Development of special programs on water quality improvement and conservation both at regional and federal levels as well as effective mechanisms on their implementation;
- effective application of regulatory arrangements on water use, including economic and administrative;
- education and transfer of knowledge to the population for better understanding of water role in ecosystem and better motivation of public activities on water quality conservation and rehabilitation.

The guideline principles of water quality and water resources management are as follows:

- sustainability - water management activities are to meet the needs of the present generation without detriment to future generations;
- ecosystem approach to water management;
- integrity of river basin waters in space and time, basin integration and territorial coordination;
- principle of relativity:
- economic reasonability;
- technical proportionality;
- specific basin and territorial compatibility;
- prudence principle - to reduce the impact of the country's economy and household activities on water quality
- precaution principle - measures on prevention of negative impact of household activities and the country's economy on waters must not be postponed even if interdependence between such impact on one hand and water quality on the other hand has not been completely estimated;
- the principle "water user pays";
- preventive principle: it is easier to prevent negative impact than to abate its consequences.

Implementation of the Project concept is carried out through a number of pilot projects in three pilot regions of the Russian Federation: Upper Volga, North Caucasus and the Urals. This Program envisages development of new approaches to water quality standards and objectives and

dissemination of the results of the Component implementation.

One of the most important tasks of the Component implementation is consolidation of efforts of the federal and regional agencies and institutions responsible for water relations regulation and water quality management to obtain the ultimate goal of the Component - that is water quality rehabilitation and conservation.

Agreement on joint activities for the Component signed by these agencies has become the first step on implementation of the above mentioned task.

Highly qualified specialists in water use and conservation have been involved in the Component implementation at the federal and regional levels. The agencies they represent are as follows: Environment Protection Committees, Water Management Committees, Sanitary and Epidemiology Centres, territorial bodies of the Water Management Committee of the Russian Federation, "Vodokanal" regional departments, territorial bodies of the Underground Resources Committee and Fisheries Committee of the Russian Federation, civil society groups, scientific-research and project institutes.

Analysis of international experience of water quality and water resources management and approaches (techniques) to implementation of the plans and programs will be carried with the assistance of foreign consultants from:

- Netherlands - **"TEBODIN"**, represents consortium which includes the Netherlands Institute of Water Management,
- **"IVACO"**- is the world largest laboratory (in Delft) of hydraulic research, specialises in development of water treatment technologies,
- Great Britain - **HALCROW**, specialises in development of various models of water quality and water resources management and mechanisms on their implementation.
- Germany - **LAHMAYER**, represents the consortium which includes French and English specialists. This firm has wide experience of activities in river Rhine and Danube Projects.

As for the water quality standards and objectives, consulting services on this task will be provided by specialists from the USA Environmental Agency, the World Health Organisation. Russian specialists and their foreign colleagues will work as one team.

What will be the basic outputs of the Component implementation?

1. The prototype of the cost-effective water monitoring system ensuring relevant and adequate information for decision makers.
2. Computerised decision support systems for water quality and water resources management (prototype of the decision support analytical centre) will be developed and tested.
3. Recommendations on restructuring of the river basin water quality and water resources management system will be developed including introduction of the required changes to the legislative and organisational structures as well as introduction of economic stimuli.
4. Various mechanisms on implementation of Programs on water quality rehabilitation and conservation at the municipal, regional and basin levels.
5. Cost-effective approaches and techniques on small rivers watersheds management to reduce water pollution load.
6. Recommendations on upgrading the legislative, financial and organisational structures for water supply systems management to provide population with safe drinking water (municipal and regional levels)
7. Prospects of the basin cooperation and coordination for water quality rehabilitation and conservation will be analysed. Mechanisms of decision-making and cooperation of the principal agencies dealing with water quality and water resources management will be developed.
8. Upgraded systems of water quality standards and objectives.
9. Various techniques and approaches to involve population in settling of the water problems.
10. Recommendations on development of Programs on environmental training and advance of the water management specialists and decision makers.

In accordance with the Component Outreach Program specialists from various regions of the Russian Federation must be involved both in the initial phases and demonstration cycles of the Project and in the development of recommendations.

Thus, the Component implementation is based on development of the management system of the "from bottom to top" type, that is separate elements of this system shall be developed at the basin (regional) level. Having been approved at the regional level they are tested in a number of neighbouring regions and submitted finally at the federal level and can be applied by the government and civil society groups in formulation of the environmental and economic legislation, regulations, rules etc.

HUMAN IMPACT ON THE ECOSYSTEM OF THE AZOV SEA, ITS PRESENT-DAY PICTURE AND TRENDS

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In view of the condition of its ecosystem, the Azov Sea is characterized in the "White Book of Russia" as a zone of ecological crisis. The irretrievable consumption of the river runoff (30-45 %), the loss of the greater part of spawning grounds due to hydroconstruction on the rivers and the development of flood plains, all this is aggravated by the pollution of the sea. In 1990 3.6 km^3 of sewage waters were discharged into the Azov Sea, it is 2,6 and 13 times more compared with the Caspian, Black and Baltic Seas, res. Water transportation and bottom dredging and dumping of sediments (up to 8 mln. m^3/year) contribute to the deformation of the ecosystem.

The following consequences of the economic activities for the sea ecosystem manifested by the end of 1980s must be mentioned:

- high levels of water pollution, exceeding 12 maximum admissible concentrations (MAS) for heavy metals (Cu, Zn, Pb, Cd, Hg), 8 MAC for pesticides and 4 MAC for mineral oil products;
- intensive acumulation of pollutants in bottom sediments (in the 2nd layer their content is greater than in the water column);
- high degree of accumulation of toxicants in organs of all living things;
- sharply decreased abundance and species diversity of the ichthyofauna;
- disastrous reduction of stocks and catches of mass fish species after the appearance of ctenophore Mnemiopsis leidye;
- serious disorders in natural reproduction of fishes (resorption of gonads, loss of homing due to which over 80 % of sturgeons stopped to come to the spawning grounds in the Don and Cuban the genetic apparatus of fishes, low coefficients of the use of the feeding base. However, over the last years serious changes have occurred in the impact on the ea ecosystem. Because of a sharp decline in production there is a tendency to the lowering of the water pllution by heavy metals (by 3-4 times in 1990-1993 compared to 1987), except for mercury, and of their accumulation in bottom sediments and fishes, though the pollution is still a very serious threat to fishes and their reproduction. An analogous trend is also observed in regard to pesticides, their use has decreased from 1987 to 1993 4 times for Rostov region and 3 times for Krasnodar region.

However, the restructuring of the national economy, greater emphasis on extractive industries and export enhance the human impact in these areas. Russia has lost many Black Sea ports, so that now there are plans for renovation and construction of new port facilities in the towns of Azov, Taganrog Temryuk. More intensive marine transportation presents an additional ecological threat in view of the diversity of the goods, the condition of vessels and the control system. Moreover, in the near future exploration for oil and gas may start.

For a number of reasons the population in the areas adjoining the Azov Sea has increased in recent years, which may also increase its eutrophication.

The present trends reflecting changes in the human impact on the sea ecosystem and the necessary reevaluation of recreational and fisher'ies potential must be taken into account in the conception of the economic and social development of Southern Russia.

THE EXTENT OF HUMAN IMPACT ON THE OFF-SHORE AREA AND COMMERCIAL ICHTHYOFAUNA IN THE NORTH-EASTERN PART OF THE BLACK SEA

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In 1993-1995 AzNIIRKH undertook 6 surveys in the Russian part of the Black Sea, from the Kerch Straits to the city of Sochi. The levels of water pollution and accumulation of pollutants in organs and tissues of commercially valuable fish species have been used to estimate the anthropogenic effect.

The great effect of economic activities on the state of the off-shore areas is evidenced, first of all, by the data on the oxygen saturation of water, by increased concentration of ammonium ions in the upper layers of water and the presence of considerable amounts of nitrites which were not earlier observed. The average value of the content of heavy metals did not usually exceed maximum admissible concentration of chrome, zinc and cadmium were found to be increasing. The average concentrations of chloroorganic pesticides (COP) exceeded MAC 3 times, of mineral oil products (MOP) 2-4 times.

Thus, the littoral zones might be regarded as the areas with a lower degree of pollution. However, when interpreting the results of observations one should take into account th specific hydrodynamics

of littoral waters confined by the Caucasian current. The data on the concentrations of pollutants in regions where anthropogenic load is high and is separately moving masses of water, usually more polluted and fresher, are also important for the reliable evaluation of human impact.

The following regions with permanently increased MAC levels of water pollutants can be singled out:

The Kerch Straits and the adjoining area: MOP - 5-10; OP - 5-6; Fe - 9; Hg - 7.

The region of the town of Anapa: COP - 6-16; Hg - 3.

The region of Novorossiisk: MOP - 12; COP - 3; Hg - 2,5.

The region of the town of Dzhubga - the village of Archipo-Osipovka: COP - 8; Hg - 8.

The region of Tuapse: MOP - 7; COP - 3.

The region of Sochi: MOP - 4; COP - 10; Hg - 4.

Such levels of water pollution may create conditions for rather intensive accumulation of the substances mentioned, in organs and it's sues of commercial fish species. (This view is substantiated by pertinent studies for the Azov Sea). It has been shown that the accumulation of anthropogenic toxicants in Black Sea fishes attains the same degree as in the Azov fish species. The highest content of pollutants was observed in liver of flounder, whiting and spiny dogfish: COP - 240-2550; 840-1150; 4030 mg/kg; Zn - 1.7-9.5; 3.0-6.5, 1.5 mg/kg; Cu - 2.0-11.8; 2.9-5.2; 1.8 mg/kg; Pb - 0.13-2.9; 0.18-0.36; 0.28 mg/kg; the respective values of Hg for flounder and whiting: 0.04-0.07 and 0.02 mg/kg.

The study of relationships between the reproductive function of some Azov Sea fish species and the accumulation of anthropogenic toxicants in their organs showed a distinct correlation between the accumulation of Hg, Cu, Pb and COP in sturgeon liver and disturbances in the maturation of gonads, i.e. their resorption. The above-mentioned data point to a real danger of the present-day levels of the Black Sea pollution for the overall condition and, particularly, for the reproduction of commercially valuable fish species in the Black Sea.

THE POSSIBILITY OF REDUCING THE NEGATIVE EFFECT ON THE ENVIRONMENT OF UNCONTROLLED EFFLUENTS FROM STORED MINING WASTES

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The development of the non-ferrous metallurgy on the Kola peninsula has caused a significant contamination of open water reservoirs with both metal cations affecting the environment adversely and surface eater acidification due to sulphur dioxide dissolution in water. Through in natural water reservoirs in the zone affected by these plants the average annual level of acidification (pH) is not lower than 5.0-6.0, in the period of intensive snow melting this value may be considerably reduce (due to the contaminants accumulated during the winter months). The pressing situation (the pH-shock) may be short-term, but bring about incorrigible environmental consequences.

Similar adverse consequences may be caused by the processes occurring in stored dumps wastes - overburden rock and tailings. In many cases these products contain sulphides, incorporating non-ferrous metals. In dump and tailing the sulphides oxidize, although slowly, with the formation of water soluble salts. In many cases the effluents from primarily the overburden rock tailings, are not controlled and, consequently, their purification directly at the storage areas is hindered. Most of the known methods of handing of such effluents can be applied at local facilities and are inapplicable for open natural reservoirs. For the latter the reagents not disrupting the ecological balance should be used.

Our studies have shown that calcium carbonate is a profitable and safe reagent for both increasing the water pH to the required level and purification from a number of metals. The use of carbonate products has a number of variations depending on the type of contamination. The increase in pH is ensured by the interaction of carbonate with H^+. As the reaction takes place on the carbonate particle surface, the treatment efficiency is determined in this case by the specific surface or the reagent dispersity. During the treatment from heavy metals the reaction products must be precipitated. The particle grain size should be relatively large, precipitated readily and not from suspensions is rough water. Recommendations on the purity, mineral and chemical compositions and optimal grain size of the carbonate product for various purposes have been issued.

A technology of the carbonate reagents production from overburden rocks of the Kola deposed of complex ores-carbonatites has been developed. This technology permits to obtain product with a quality meeting the European standards without using flotoreagents.

POTENTIAL REASONS AND CONSEQUENCES OF HYDRAULIC STRUCTURES DETERIORATION

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Water retaining hydraulic structures are in the number of the most safe engineer objects. But the history of hydrotechnical construction contains examples of possibility of theirs deterioration and even complete destruction under the influence of natural and anthropogenic factors. Floods are the most destructive and globally frequently repeated natural calamity. Theirs share in the total amount of all kinds of natural calamities exceeds 40%. With insufficient discharge capacity of outlet works super-estimated floods cause dam overtopping and its destruction. A considerable threat to hydraulic structures present such factors as seismic influence as well as landslides and rockfalls, snow slides and mud flows and in perspective changes in the conditions of flow formation under the influence of global climate warming.

In the last decades of 20th century anthropogenic factors became determinant in deterioration of engineer structures, including hydraulic units. Accidents and dams deterioration observed recently connected with the growth of the total number of dams (more than 85% of all dams were constructed in the world during the last 35 years), especially ground dams that suffer destruction much more often then concrete dams; with the dams construction in less favourable for their exploitation regions, with aspiration for more economic projects and etc. Unpremeditated actions of stuff mostly of professional-practical character can be the reasons of accidents. Recently the danger of dams deterioration or destruction sharply increased in zones of military actions and ethnosocial conflicts.

The most important after-effects of hydraulic units deterioration are formation of the wave-of-breach and inundation in the downstream territories, accompanied by considerable damage and demoecological losses. Damage and losses depend not only on wave-of-breach parameters, but on many factors - weather conditions, ecological state of the territory, time of accident (season, daily time), early notification and warning, population preparedness for emergency situations, state organisations readiness for possible unfavourable events.

Besides downstream inundation there is a danger of reservoirs draining, being accompanied by stirring up exogenic processes, by formation of shallow stagnant zones with unfavourable bacteriological regime. The chief thing is uncovering of the bottom sediments, containing toxic agents, heavy metals, pesticides, oil and etc. For all these plotting maps of potential consequences of hydraulic units destruction is of special actuality. These maps show not only total areas of inundation, underflooding and uncovering bottom of reservoir, but zones with different degree of danger (depending on the wave-of-breach velocity and height and intensity of water escape from reservoir). Such maps are plotted in the Institute of geography RAS for cases of hypothetical destruction of some hydraulic projects of the Volga cascade.

MODELING AND NUMERICAL INVESTIGATION OF IMPURITY SPREADING IN WATER RESERVOIRS

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In the work the numerical investigation method of unstationary process of impurities in water reservoirs intended for domestic water supply is offered. One of the ways of modeling of the conservative impurity spreading on water reservoirs is given in /1/ in detail where the equation of continuity and the liquid movement are considered in a simplify way.

In the work given the study of multi-phase movement of environment is carried out on the basis of "sallow water" equations where the process of precipitating the heavy fractions of hard impurities is taken into account as well. While discretizing the equations the non-obvious Krank-Nickolson scheme of second order of approximation was used /2/. The pictures of water flow and spreading the impurities in big water reservoirs are obtained. The concentration fields of passive impurities are analyzed in water weir depending on time, and the silting process in reservoirs as well.

Results of the work are of interest for solving concrete tasks connected with the problem of domestic water supply and forecasting the unfavorable ecological environment.

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MINING INDUSTRY IMPACT ON WATER RESOURCES QUALITY (BASHKIRIAN ZAURALIE AS AN EXAMPLE)

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Enterprises of mining industry complex of the Republic of Bashkortostan are mostly concentrated in the area of Bashkirian Zauralie. Bashkirian Copper & Sulfur integrated industrial complex, Uchali ore dressing factory an Buribai ore-mining department define now and are sure to define in future the environmental situation in the region. Overburden rock dumps and residue water storages of dressing factories are very strong and permanent contamination sources for surface and underground waters and soils pollution by heave metals. At the same time they are in fact technogene deposits where, using up-to-date technologies, it is possible to recover zinc, copper and associate gold, silver, platinum and other useful components.

Investigations have shown that metals, including heavy ones, are the main sources of environment contamination. Considerable concentrations of metals have been found in water reservoirs and soils.

For example, concentration of iron, copper, zinc, manganese, chromium, silicon in the rivers Tanalik and Buzavlik is exceeding the maximum permissible concentration for fishing water reservoirs.

High concentrations of iron, manganese, copper, zinc and chromium have been found in underground waters.

As a result of underground and surface waters contamination drinking water in water intakes (Khvorostiansky, Buzavliksky, Petropavlovsky) does not answer the requirements of State Standards for contents of iron, copper, chromium; there are cases of exceeding the norms for chlorides, nitrates, phenols.

In dumps and residue water storages of mining and ore-dressing enterprises, the volume of which is scores and hundreds of millions cubic meters. a considerable amount of metals (more than 20 elements) is concentrated. As a rule, dumps and residue water storages are situated in water-protection zones of water objects and they are, in fact, constant contamination sources for water resources. soils and air.

In under-dump waters concentration of many metals exceeds maximum permissible concentration by hundreds and thousands times.

As a result of researches in 1995 preliminary recommendations on creation of environmental monitoring system in Zauralie have been worked out. It has been decided to carry out a set of researches aimed at studying conditions of forming water resources quality, main sources of antropogene impact on surface and underground waters state and development of water-protection measures.

MILITARY TECHNIQUES UTILIZATION FOR ANTI-POLLUTION PROTECTION OF MARINE AREAS

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The activity of the water organism and communities is a major factor in the water quality formation. Long-term investigations on the interaction of marine organism and their communities with pollution allowed to outline a possible aimdirected utilization of hydrobionts to clean polluted sea water and to rehabilitate sea aquatoria. In each concrete aquatirium there's formed its artificial community of water organisms - a hydrobiological cleaning system. Various types of hydrobiological cleaning system for sea water and for coastal aquatorium rehabilitation from pollutions are developed. In the bases of one hydrobiological cleaning system variant lies a variety of a mine-torpedo device. The 2-year-experience of this system exploitation showed its high efficacy in removal suspended and emulsified pollutions from sea water, including oil products. in conditions of one oilterminal, dislocated at the Black Sea, over 50% of potential technological oil spills was prevented during one year.

CLEANUP OF OIL POLLUTED WATER BY NATURAL MICROMYCETES

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The possibility to use cultures of natural micromycetes for the cleanup of water polluted with superficial oil and oil-products has been studied.

The strain Penicillium sp. B2/2 was isolated from an oiled soil sample. The strain Aspergillus sp. 1H was isolated from the mixture of oils obtained from West-Siberian and Ukhta oil-fields. Both strains were cultivated in the liquid mineral medium supplemented with fresh and marine waters over a wide range of temperatures (10° to 25°C). Oil and residual oil were used by them as a sole source of carbon and energy. During the growth of micromycetes, the oil substrate, spreading initially as a superficial film (0.5-3mm), underwent transformations. Light oil fractions volatilized, and some hydrocarbons were subjected to biodegradation by micromycetes with a subsequent formation of fungal mycelium. A significant portion of oil was absorbed and adsorbed by mycelium and immobilized onto this biological sorbent.

A water superficial fungal film formed was easily removed mechanically 7-20 days after to provide the oil-free water surface. All above processes were different in their quantitative contributions that were evaluated according to the weight method after oil extraction with chloroform. So, oil utilised was found to vary between 2% and 20%. The biosorption process was superior compared to the other ones, efficiency varying from 30% to 80%.

Despite the moderate ability of micromycetes to biodegrade hydrocarbons, micromycetes isolated by us exhibited the high level of bidegradation due to biosorption (70-98%). They were found to be superior to other available bacterial preparations. The efficacy of micromycetes-based biosorbent was 6-80 mg of oil/mg of fungus (by dry weight). The preparation by its sorption properties is competitive to up-to-date chemical preparations, such as foam polyurethane, rubber crumb, pearlite, vermiculite, etc. The sorbent is non-toxic and capable of self-regenerating using hydrocarbons as a source of carbon.

Thus, Penicillium sp. B2/2 and Aspergillus sp. 1H strains isolated combine both biodestructive and biodegradative properties. They are effective in the cleanup of superficially oiled fresh and water environments over a wide range of temperatures. Preparations based on these strains are presently being developed.

Activities have been implemented within the framework of Project #119- 95.

LOCAL EFFLUENT WATER RESOURCES OF VORONEZH REGION, THEIR RATIONAL USE AND CONTROL

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In regions with unstable and deficient humidification among which is Voronezh Region local (springtime surface) effluents of minor rivers and temporary stream flows from the greater part of overall water resources. Frequently the local effluent flows are exploited here as the only source of the irrigation and water supply, industrial and agricultural water supplies. Based on the local effluent flows, constructions of ponds and water reservoirs has reserved wide recognition. As a consequence, level of domestic development of water resources and their protection against exhaustion and pollution is to be interpreted significantly by the degree of water employment in respect to this sort of effluents.

For the territory concerned maximal snow cover accumulated for the beginning of the process of spring snow melting at estuaries of minor rivers and temporary stream flows provides the source for humidifying the agricultural land and the main agent which forms the local effluent flows. Summer- and autumn-time precipitation does not play a vital part in forming the local effluents since it, for all practical purposes, is completely used up to the processes of evaporating from the soil surface and damping the soil surface layers.

In relation to the pronounced region relief erosion dismemberment (ravines and gullies occupy 12% of total region square) and insular spread of forest vegetation, the region snow cover is bedded extremely irregularly. The snow is blowed off from the fields to the ravines, gullies and obstacles of other kinds. With currently established agricultural system, distribution of the maximal snow cover for basic landscape forms is characterized by the following data obtained as a result of the development of a new method for construction of maximal snow cover maps:

– in fields - snow cover accumulated by the late winter occupies 2, 54 km^3 (65%);

– in plots cut with ravines and gullies - 0, 88 km^3 (22%);

– and in forests - 0,51 km^3 (13%);

On the territory of the region the local spring-time effluent flow rate changes from 66 to 40 thous. m^3 per 1 km^2 of the north to the south and from 64 to 60 thous. m^3 per 1 km^2 of the west to the east. The average long-standing value of the local effluent resources constitutes 1,2 thous. m^3 per capita which is 1,5 times less than in neighboring Tambov Region and is 1, 25 times less than in Kursk and Lipetsk Region. In case of the minimal average value for spring-time surface effluent coat (53 mm), due to its square (32,4 thous. km^2), Voronezh Region has the greatest effluent volume (20.7%) in comparison with all region of Black Soil Area which is equivalent to 2, 78 km^3.

Based on its geographical location and significance of the relief the regional territory may be separated into three zones:

– zone of increased local effluence (northern districts) where the specific provision with local effluent resources exceeds 60 thous. m^3 per 1 km^2,

– zone of relatively moderate local effluents (central districts) with the specific provision of 50-60 thous. m^3 per 1 km^2,

– zone of decreased local effluents (southern districts) where the rate varies between 40 and 50 thous. m^3 per 1 km^2.

In area of the main region waterway which is Don, with its length of 530 km, from Lipetsk Region to Rostov Region, in the year of its 50% water provision 5% of the local effluents is exploited for the national economic needs, 11% - for loading ponds and water reservoirs and appr. 1% - for additional evaporation at anthropogenious reservoirs surface. The other 83% of the effluents arrive at lower lands. On the territory of the region, in the year of 95% water provision appr. 22% of spring- time surface effluents is to be used. Less than 20-40% of annual effluents are accounted for by the remaining 9 months (from June to February), which are of the period of the lowest water level, of which 10-12% should remain in the rivers for the fish-breeding and sanitary purposes. It flows from the said above that during the period if the the lowest water level only 10-30% of the annual river effluents can be used.

In an effort to protect the local effluent resources against their exhaustion and pollution in the region, in parallel with the erection of purification plants, the work on removal of objects having deleterious effect upon water state is to be completed in water preserves. The process of banking up farms and store0houses for fertilizers and pesticides has been completed for 80% of farmsteads. Among 1288 springs registered 786 springs are under control and care. The process of cleaning is under performance now for a number of rivers (e. g. Usman. Boguchar etc.). As a result of measures taken the water quality of Voronezh and Khoper rivers has been improved where their water quality category has changed from the category IV-"polluted"to the category III-"moderately polluted".

EVALUATION OF RELATIVE STABILITY OF BOTTOM NATURAL COMPLEXES OF SEA SHOALS UNDER LOCAL ANTHROPOGENIC ACTION

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The problem of determination of the landscape stability under anthropogenic action and substantiation of the ways and methods of rational nature use is based on the evaluation of the stability of their components. Different components of natural complexes were evaluated by numbers on the basis of approximate qualitative substantiation. At the same time, an equal number was assigned to each factor of landscape components. This paper first tries to substantiate in degree the number evaluation of different landscape components, case study the bottom natural complexes (BNC) of sea shoals.

EXPERIMENTAL DESIGN

The initial information was obtained at the Sea of Japan shoal 60 km in extent, at the depths from 0 to 40 m. The technique of simultaneous collection information by means of the echo sounding, benthos and soil sampling with the help of bredges and divers, hydrogeological survey, and visual observations was used in the study of the landscape structure. As a rule, each reference point characterized the uniform bottom section, which is the smallest morphological unit, and was described by the standard set of qualitative and quantitative indicators. The BNC were classified according to the technique worked out by Mitina on the basis of qualitative data processed by means of pair linear correlation analysis (Mitina, 1993). The environmental quality of BNC was generalized by Yu. Odum (1975) technique.

RESULTS AND DISCUSSION

The landscape components affect each other with varied intensity and are of different degree of stability (Solntsev, 1960). Therefore, it is necessary to distinguish qualitatively the participation of each component in geosystem formation for the evaluation of a landscape's stability.

After analyzing the absolute values of pair linear correlation coefficients for the factors of different landscape components in the shallow water zone of abrasion-accumulative bay coasts of the Sea of Japan, we determine that the indicator characterizing the streams disgorging into the shoals (low water discharge) is of the strongest correlation connection, (K= 0,867¯0,9). Other indicators are ranged in the decreasing order: coastal relief (K= 0,822¯0,8) and lithology (K= 0,680¯0,7); bottom relief

(K=0,575˜0,6); hydrodynamic and hydrological indicators of water masses (K˜0,5); bottom vegetation - macrophytobenthos - (K = 0,328˜0,3); bottom soils (K = 0,255˜0,25); and macrozoobenthos (K=0,212˜0,2). We suppose that the intensities of interaction of landscape components in the specific landscape are arranged in the same order. One can imagine them in the form of pyramid, which characterizes in degree real distribution of the intensities in the established geosystem. The biotic landscape factors may be even more valuable for the sea landscapes with lithogenous base of biogenic origin, for example, for coral reefs.

The value of each factor must by in accordance with the specified number while evaluating a landscape's stability. We propose to count the amount of numbers by the tenfold correlation coefficient and to round off it to the nearest integer for convenience in counting the resource evaluation. The soil indicators should by rounded off to the tenths, because they are out of the general scheme of hierarchic connections.

The observed shoal area is adjacent to the abrasion-accumulative embayed coasts formed by the mountain range, which forms several bays confined to the mouths of small rivers by means of a number of smooth embayments. While analyzing hydrologic and hydrodynamic parameters, we found out two types of water bodies, freshened and non-freshened ones, which differ by a stratification type of water body and by a salinity condition. The background and polluted water are established by the condition of alga communities within the limits of freshened water bodies. Mine wastes come with a river flow to an observed coast area of sparse population and slight development . It ts comparable with unfavorable natural processes such as high hydrodynamic wave activity, for example, and it is of local character.

According to the opinion of Yu. Odum (1975), the increase in the stability of any system is ensured by either raised stability of its constituents or the optimization of distribution of relations between them. The more feedbacks operate in an ecosystem, the higher is its stability (as well as a stability of many other systems), i.e., the greater is the amount of cycles which ecosystem elements are incorporated into. Thus, an ecosystem stability is in proportion to the amount of feedbacks incorporation ecosystem elements. While analyzing the graphs, the relations of landscape profiles of the shoal zone under study, we established that the amount of correlation feedbacks decreases under local anthropogenic action, i.e., in bottom natural complexes (BNC) with freshened-polluted water bodies. Maximal amount of correlation feedbacks is typical of BNC with freshened-background water bodies. These areas of mixing of marine and river waters are of prime importance being the zones of increased bilolgical productivity and those of accumulation of organisms, which are the early onthogenesis stages and settle all over the sea basin.

An ecosystem stability holds on strong relations as well as on the assemblage of weak ones (K.M. Petrov, 1993). It is established that the amount of strong correlation binds (K= 1,0-0,7) is less than that of weak ones (K= 0-0,3) at fixed amount of different properties of BNC components. Benthos holds on a fan of weak relations, whereas the amount of strong relations is confined to two, rarely to three ones. Therefore, one must evaluate the stability of geoecosystem, which the landscape of shoal under study belong to, by the integral amount of indications of different landscape forming factors.

CONCLUSIONS

1. The landscape components are of different values in the system of landscape forming factors. Using the quantitative methods, we determine that a certain number corresponding to the values of the coefficients of pair linear correlation are assigned to different factors of landscape components.

2. BNC of the aquatory area under study is of different stability depending on the environmental quality, which is determined by the amount of feedbacks of pair linear correlation coefficients. The BNC characterized by the most favorable ecological conditions obtain the maximal amount of correlation feedbacks.

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HYDRAULIC POWER ENGINEERING IN RUSSIA UNDER CONDITIONS OF MARKET ECONOMY

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The water power potential of Russia economically feasible to be developed is estimated at 850000 GWh a year, about 20.9% of which are already being developed. This is, however, lower than in other industrially - developed countries (France, Switzerland, Germany - 65-90%, USA, Brazil, Canada, Venezuela, Spain, Italy - 45-65%, India, Argentine, Mexico - 20-25%).

The share of water power in total electric energy generation by all power plants of Russia makes up 20.6% (in Norway - 99.6%, in Brazil - 90%, in Austria - 70% and in Canada -66%).

Hydroelectric plants have a number of ecological, economical and technical advantages as compared to other power sources:

- continuous and expenditure-free renewable power source whose utilization is now equivalent to the annual output of power-generating coal in the Kuzbass and nealy double annual coal output of the Kansk - Achinsk basin;
- lower cost price of generated power than at steam power plants (8-9 times as less in the European regions of the country and 5-13 times in Siberia);
- practically unsusceptible to inflation;
- approximately 20 times lower labour consumption required for operation and maintenance as compared to steam power plants (considering mining and transportation of coal and fuel) which results in saving about 400 thousand employees for other industries;
- wide range of power regulation and high monoeuvkability which result in upgrading the operation modes of steam and nuclear power plants;
- multi-purpose use of water resources for covering the needs of the population and national economy;
- environmentally-benign power source without harmful wastes which is the most important social effect of hydropower engineering.

The environmental impact of hydropower developments consists in impoundment of reservoirs and associated land flooding and underflooding, bank transformation, changes in microclimate, fauna and flora environ conditions. Sometimes it necessitates relocation of the people from the zone of flooding.

In the latest years wide scientific-research work has been done in the country to study the impact of reservoirs on geological, water and air environs and their ecological systems as well as on the social environ. New methods have been developed to predict the environmental impact of would - be reservoirs, to specify the ecologically - permissible parameters and optimum operation modes of these reservoirs, to identify the necessity for additional engineering works intended for mitigation and elimination of any adverse after-effects and taking measures to compensate for damages and losses in the part which cannot be eliminated completely as well as to estimate compensations for material and moral losses incurred by a community and its separate members. Performance of this work will give guaranty that adopted for implementation are environmentally-benign and socially-equitable projects.

Comparison of cost-effectiveness of hydro and steam power plants under the conditions of transition to market economy confirmed higher effectiveness of hydropower engineering. This is the main reason for intensive water power resources development all over the world.

THE METHOD OF COMPLEX ESTIMATION THE QUALITY NATURAL WATER

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It is known that the nature water protection against pollution and close connected with it the task of estimation its quality is actual problem now. The complex estimations of natural waters pollution are enough heterogeneous system of methods of formalization in different degrees. This variety is caused by various levels of development water subjects, aims, and tasks of the estimation water quality, variety of positions on which it is produced. As a result, now there is no unanimous, generally accepted method of complex estimation of surface pollution or ground water. So, from all avariable variety of methods must be used one which better than others supplied by necessary information and gives most adequate estimation of the water pollution degree of the considered water subject.

The development of the universal and at the same time enough concrete methods used to diversity of conditions water subjects is inevitably leads to methods multidimentional statistics. There are examples in literature to show purely using approach to its developing to be expressed either in insufficiently quality of information or in illegal combined of the results of different methods.

The offered methods of estimation natural water quality is based on the basis of the classic model component analysis, and (developed be the author) on the algoritmes and software which enlarge the possibilities of the method. The method permits to realize both the system and complex approach. The complexity is supplied by the system and complex approach. The complexity is supplied by set of signs which is developed into common task, and systematy, on one part by hierarchility, and on the other part by revealing function of system, in present case it is the process of transportation. This method gives the possibility to carry out multiplaned hierarchy. The component analysis permits to pick out

hierarchy of the transportation process (on set signs in each component) by accounting of weight (contribution) of component in total dispersion of system, and after that to divide into districts the territory according to the intensivity transmission degree of the material-energetic streams by using the matrix of component meanings (the result of solution of the component task) in each range.

The method standard loading developed by the author gives the possibility on one part to compare the intensivities of transmission processes, and on the other part the possibility to organize artificial hierarchy of lots, and select the cleanest lot and define for it the hierarchy of material-energetic streams and its intensivity on ranges which take place standard lot, and then to estimate the changing intensivity on the all other lots (in the same units of measurement as for the standard lot). On this standard matrix of loading it is possible to compare the changings too. It is difficult to use method because of the presence of the minimal quantity of testing (points) which are needed for statistic development. That is why it is necessary momentary testing the basin with intermediate (but only observated ranges) testing points and with maximal full set of the possible to use common regim of testing, but the meaning of missing parameters can be restored by using additional multidimensional methods with due to regard developed hydrochemical processes. Another mass testing may be repeated for the control maintenance of standard criteria of accuracy of missed parameters definition.

ENVIRONMENTALLY SOUND FLOW SCHEMES PREVENTING DISSOLUTION OF SALINE SOILS IN THE FOUNDATIONS OF STORAGE DAMS

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In some cases storage dams are erected at cross-section where bedrocks contain water-soluble salts. Within the territory of Union of Independent States such rocks are widely spread in the south and east of European part, East Siberia and Central Asia. The occurrence in dam foundations of rocks containing soluble salts leads to the cancellation of construction of dams in a number of case or requires the development of engineering measures for chemical suffusion control. These measures significantly increase the cost of construction and sometimes the need for measures leads to the refusal from the construction of water retaining structures at cross-sections selected on the basis of feasibility studies. In addition data being available show that even having provided engineering measures on chemical suffusion control, in the course of operation antifiltration elements of dams erected on soluble foundations loose their properties and need regular restoration. However, the experience of operating dams at Kamsk integrated power development indicates at possibility of effective construction and long-term operation of dams having foundations of rocks containing soluble salts.

There are known some cases when dams at integrated power developments were erected on saline soils without provision of any measures on chemical suffusion control. As a rule, operation of dams was already impossible in the design alternative.

All existing control measures preventing dissolution of saline soils in dam foundations fulfill a passive or an active function. In the former case control measures preventing dissolution of salts in the foundation of a retaining structure only retard the dissolution process, but in the latter case they actually stop the process completely without disturbing natural state of water bodies. Flow scheme providing implementation of engineering measures preventing dissolution of saline soils in storage dam foundations are described in the report.

THE USE OF ASSIMILATING ABILITY OF WATER ECOSYSTEMS IN THE PROCESS OF FORMATION OF SURFACE WATERS QUALITY IN THE CONDITIONS OF ANTHROPOGENIC INFLUENCE

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Ecosystematic approach to water management activities should define the system of optimum measures and ways of management. Measures for water-preservation should include measures on water resources protection, which include the following: precaution measures, aimed at reducing of

harmful impact; such measures should embrace all stages of water management activities; measures in the field of distribution, providing the balance of anthropogenic load on the water bodies with the help of its distribution in time and place taking into account assimilating ability of different parts of this ecosystem;compensative measures, aiming at liquidation (reduction) of the harmful impact.

Different natural factors and anthropogenic load influence greatly at the state of such water management system components as lakes, rivers, channels and other water bodies.

Particularly, sewage discharge into the water flows is the necessary measure, which will be realized for a long period of time. In the Urals Economic Region, for example, nearly 1 milliard cubic meters of sewage come into the water objects, 41 % of which come without any treatment, 35-44 % is partially treated. The increase of the sewage volume, subjected to treatment, improves the quality of the water in water sources, but does not solve the problem of pollution income into the water objects. Ingredients, coming into the natural waters, are subjected to some changes, which determine assimilating ability of water objects and influence the dynamics and the character of the water quality formation. That is why the question about the use of assimilating ability of water body in order to regulate the water quality in it, is quite natural. Taking into account the importance of the problem, the scientists of RosNIIVKh have worked out the methods and technology of regulation of the surface waters quality and the methods on prevention of small rivers pollution with metals, coming from the dispersed flow.

As the base of these methods we take the ability of higher water plants to regulate an active reaction of the medium , facilitating hydrolysis processes, processes of sorption and co- sedimentation . Besides, the plants are able to absorb metal compounds, which are transmitted into compounds, not able to be a water mass in the existing medium. Besides, there are methods, facilitating the prevention from the secondary pollution with the metal compounds from the water-catch territories and defined areas of water, containing sewage of the concentration-mill production of copper-melting industry (pyrites and other sulphide-minerals). With this goal, the limits of toxic characteristics for a number of water plants were determined in accordance with metal compounds and pH volume, some new constructions for this process and conditions of their operating were worked out .

Experimental monitoring was held at botanical station of 2 hectares and 10 000 cubic meters in volume. This station was situated at the old dump field, the content of pyrite in which was not less than 10 %. During the summer period, when the waters with high concentration of metals and low pH volume came at this station , the degree of water treatment was not less than 90 %. At this station nearly 3 tons of iron, zinc, nearly 800 kg of copper, 2 kg of arsenic and practically all quantity of cadmium were collected.

Similar monitoring was held at Shigirsky Lake, the "dirty" part of which is used as a collector of industrial sewage of copper-melting plant for about of 50 years and which represent in fact the natural botanical station. The data, received at this lake, fully approve the results of the experiment, shown above. Secondary pollution with metal compounds did not take place in both cases. Besides the metal compounds, some other harmful ingredients were also removed out of water. Regimes of such botanical station operation were worked out, which help us to reach the degree of treatment not less than in vegetation period.

PURPOSE BASIN PROGRAMMES AND THEIR SCIENTIFIC MAINTENANCE

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Complex basin water management programme to reach stable development is considered to be a mechanism of the basin water resources management.

The federal status of these programmes for the basins of great rivers will allow to use such forms of cooperation to unite the efforts and actions of the Federation subjects, which are fixed in the basin agreements. Within the framework of the general basin programmes", such as "The Volga restoration" or "The clear Ob", some private federal programs should be realized - " Providing of Russia with drinking water" , "Protection of gardens and human settlements from floods" and also some purpose programmes of the Federation subjects. All these programmes are fulfilled through interconnection of the projects, works and measures all over the territories by the coordinate basin Committee , which regulates basin water management relations in accordance with the Programme.

It is evident that in the conditions of the formation of the new state water-management policy , which deals with the water management as with the leading resources-providing and nature-protection branch, it is necessary to work out the common scientific base of all these purpose programmes.

The lack of the programme of such scientific maintenance of the branch leads to the following: different scientific-methodical approaches are used as the scientific base of the existing programmes on water-management problems, some questions are worked out with different degree of detalization, besides some investigations become old even being yet a project because of the fast changes in eco-

nomic and law conditions of the whole economy complex functioning. In such a situation the effect of the water management in the river basins is very low, systematization principal by the realization of the / basin programme is not fulfilled.

Scientific maintenance of the programmes (in other words, the scientific maintenance of the water management branch) should unite scientific-research and project-technological works with fast working out of the strategy for management and production structures of the Russian Water Management Committee.

Estimation of the previous scientific-technical programmes in the field of water management shows, unfortunately, that there are practically no sections, which may be closed as already realized. Old problems remain , new problems appear , they, unfortunately, deal not only with the technical progress in the branch but also with the questions of extreme situations, and economic security.

We think that the programme should include the following main directions:

- legislative providing of the branch;
- working out of the planning methodology of the stable water-use system;
- methodology of the management in water economy;
- methods of estimation and prognosis of the ecology state of the water resources and their influence on the environment and people's health;
- restoration of the water-catch areas;
- restoration of the water bodies;
- reconstruction of the water management complexes of the basins;
- scientific maintenance of the programme;
- computerization of the branch;
- social-ecology monitoring;
- ecology education of the population;
- mechanism of the programme realization.

Scientific maintenance is one of the purpose basin instruments, providing the mechanism of the programme realization.

RADIACTIVE SEDIMENTS SECURITY FOR WATER BODIES POLLUTION PREVENTION

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Film protective coverings with high radioactive resistance and adherence are quite necessary for environmental protection from radioactive sediments and their uncontrolled penetration and spreading. Such compounds can be used for temporary protection from ionizing radiation in the presence of radioactive sediments for example covering the polluted ground with prolonged period of decontamination with the aim of preventing the following migration of radioactive sediments and water body contamination.

To protect water bodies from contamination the department of building materials of the Penza State Institute of Architecture and Construction proposes composites radioactive sediments security, which from film covering after putting on the surface.

The composites are put on the surface with the help of all means of varnishing and dyeing techniques.

According to the results of the experiments we can offer the optimum composite compound, which possesses the maximum density (2690 kg/m^3), high coefficient of γ-rays weakening. The composites are enough radioactive resistant.

Physico-mechanical properties of the composites are the following:

Table.

Density, кg/m^3	2360 - 2690
Water absorption, %	5,04 - 8,70
Coefficient of moisture diffusion, x 10^6 cm^2/c	0,13 - 0,232
Vital capacity, h.	1,5 - 2
Time of hardening, h.	6 - 8
Viscosity according VZ-4, c.	35 - 70

ANALYTICAL ESTIMATION OF THE TECHNICAL APPROACH ASSUMED FOR ENGINEERING DESIGN OF ENVIRONMENTAL INSTALLATIONS IN ZABAIKALJE

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Water pollution presents in itself a complex of issues, connected with small amounts of heavy metals and radioactive substances, which can endanger the life of living organisms. More ordinary but also extremely unpleasant are organic contaminants such as oil products, pesticide, surface-active substances.

The expert analysis of more than ten nature protection installation presented to the Buryat State Committee on Ecology in 1993-1995 showed:

1) non-competitive projects are much less effective. As a rule, designers choose ineffective, outdated, 10-15 year old decisions without due regard for the newest achievements in sewage disposal;

2) sewage treatment plants are designed to fit the sewage volumes, which are defined by a customer without any analysis of the existing situation in the enterprise and specific workplans of how to reduce sewage disposal. This increases the design output of buildings and the cost of construction;

3) the construction of biological systems of sewage treatment for enterprises in being planned, but this work has a seasonal character which predetermines their unstable mode of functioning;

4) there still remains the problem of ammonium nitrogen removal from biologically treated sewage to keep up to the standards established in the Lake Baikal region;

5) a tertiary treatment of sewage from suspended substances can in many cases be solved bythe installation of sand filters, though the use of natural zeolite as a filter media is more effective;

6) there still remains the problem of disinfection of biologically treated sewage without the use of chlorine;

7) solid wastes from waste treatment plants have been utilized by way of dump burial, which can eventually lead to the secondary environmental pollution.

It is necessary to note that inadequate technical decisions are due not only a low professionalism of people who do it, but also to their being disinterested in the search of better technologies for water treatment and the optimal way of water consumption.

It is necessary to return to the enterprises the money from the payments for pollution only if it is used for the newest technologies and treatment methods, which can dramatically improve the ecological situation conditioned by the activities of this enterprise.

In the process of developing the most efficient sewage treatment technologies for this or that interpose, it is necessary to stick to the following criteria: to return water, energy, reagents, etc. as near to the place it was taken from as possible; - the discharge volume under the treatment should be minimal; - the concentration of pollutants in the water under the treatment should be utmost suitable for the given technological process; - the number of technological operations should be minimal in the process of treatment; - the choice of this or that technology of sewage treatment should be conditioned by the price cost of already existing constructions and treatment technology including the cost of power, reactives, payments for pollution, the cost of municipal water discharge, the personnel fees.

THE CHARACTER AND THE LEVEL OF THE POLLUTION OF THE LOWER DON

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The quality of the river Don water depends all the way from the Tsymlyansk reservoir to the river mouth on both the ntural factors and the anthropogenic load, in particular the industrial and municipal sewage discharge. The tributaries of the Don, the Sev. Donets, Sal, Manych, Aksai and Temernik with their waters polluted by industrial, municipal and agricultural sewage affect greatly the quality of the Don water.

The main results of the investigations conducted in 1990-1995 are as follows:

- the regime of the dissolved oxygen in the water of the lower Don in nondeficient which fact can be explained by sufficient velocity of the river flow and frequent wind-provoked rising and lowering of the water level;
- the pH value was within the optimal limits (7.0-8.5);

- the content of the nitrogen and phosphorus compounds in the water of the lower Don was normal throughout the peiod under study. Maximum admissible concentration of ammonium nitrogen was 15.8 times too high in the river Temernik.

The excessive amount of Mac in regard to the mineral oil products was observed practically everywhere. The biggest level of this pollution 0.41 mg/l (8.2 MAC) was found in the Don 0.5 km downstream from the bridge crossing the Don near the town of Aksai. Along the stretch from Rostov to the mouth the concentration of mineral oil products amounted to 0.16-0.34 mg/l (3.2-6.8 MAC), with the maximum at the site of the 2nd Rostov Sewage pipe.

In the bottom sediments the total content of mineral oil products ranged from 0.07 to 1.12 mg/g. The highest values were observed at the sites of municipal sewage discharge in Rostov (0.8 mg/g) and Azov (1.12 mg/g).

The analysis of the content and composition of RAN by the method of capllary gas-liquid chromatography showed their diversity. The summary concentrations exceed the admissible norms. Benzfluorene, benzo-(a)-anthracene and benzo-(a)-pyrene were found in the Don. Their concentration exceeded the Mac (5 ng/l) by 35-42 times in two samples obtained at the site of the second municipal sewage pipe in the Don and near the mouth of the Temernik. This fact alone indicates serious ecological trouble in the region under study.

The investigations conducted revealed a high level of pesticide pollution in the lower Don. Isomers of hexachlorcyclohexane and DDT metabolites are the most frequent.

The total of chlororganic pesticides varied from 6.9 to 53.0 ng/l in the Don water.

The distribution of concentrations of heavy metals in the lower Don is characterized by nonuniformity. Near the town of Aksai the MAC was not exceeded in regard to metals with the exception of mercury from the mouth of the Temernik and to the Don mouth the concentrations of all the metals rise noticeably. The MAC of copper, zinc, iron and manganese were exceeded here.

Thus, the study of the pollution of nature in the lower Don has produced the following findings:

The greater amount of most of the pollutants enter the main river bed and its mouth streams in the region of the lower Don.

The river Temernik, Sev. Donets, Sal and Aksai as well as sewage waters of Rostov and Azov affect greatly the Don water quality and increase the pollution level of bottom sediments in the area under study.

According to preliminary assessment of the situation these areas must be described as the areas of a threatening ecological situation.

ECO-TOXICOLOGICAL STANDARDIZING OF NATURAL WATER SELF-PURIFICATION ABILITY

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The term "water quality" includes from one hand the degree of pollution of natural and sewage waters and from the other hand its biological quality providing the living of hydrobionts at some level of biodiversity and the ability for self-purification.

Water quality requirements may vary with the purpose of its use: portable, industrial, recreational, and hydrobiological.

The decrease of sewage discharges into waterbodies (in recent times) does not always lead to the biological water quality improvement. Its cause lies in the deep degradation of water ecosystems: minimal biodiversity, extremely low assimilation potential and as a result low self-purification ability. In such situation great and sometimes vital importance has the accumulation of pollutants in bottom sediments and tissues of hydrobionts.

Water quality assessment is performed in two main ways: physical-chemical and biological (bioassessment and bioindication). Assimilation potential or self-purification ability is indirectly assessed by the above methods. At the same time for the sake of water ecosystem protection and conservation that ability must be critical determining anthropogenic load onto an ecosystem. However, a comprehensive knowledge of water biology is necessary.

We develop our own strategy and tactics in determining the criteria for water quality assessment and load on water ecosystem. Current scheme: maximum permissible concentration - maximum permissible discharge - bioassessment is inferior to the determination of survivability of water communities (even simplified ones - microcosms) by our consideration.

the strategy is in mathematical modes of water quality design which bears the ability to create numerous eco-toxicological conditions and their comparative analysis. This modes may be used as a prospective tool of nature water quality formation prognosis.

The tactics is in field studies of waters and their laboratory reconstruction to some extent with the following extrapolation of obtained data to nature processes.

For this purpose we propose a complex procedural scheme of sewage and natural water quality assessment on the basis of bioassessment, bioindication, and physicochemical methods of analysis.

AUTOMATED GEOECOLOGICAL SYSTEM FOR THE ANALYSIS OF SUBWATERSHEDS AND DISTRIBUTIVE AREAS

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For a given object (a part of road, hydrotechnical construction, etc.) a part of land surface may be pointed, which is able to provide a water in it by ground runoff. This part is known as a subwatershed of this object. For a given object, a part of land surface may be pointed also, on which can be distributed a water, that posses across in - the distributive area of the object. Determination of subwatersheds and/or distributive areas is of value in geoecological applications, when there is a need to detect areas on the terrain, which are responsible for the contamination of this abject (borehole, hydrotechnical construction, etc.), or to find areas for a given object, on which contaminants may be distributed by ground waters.

Besides, there may be heterogeneities of catchment area inside a given subwatershed, or a distributive area (so called specific catchment area).

The automated system under consideration determines corresponding subwatershed (or distributive area) for a chosen by user object, and calculates map of specific catchment area for it. In each point of the subwatershed, the program can view a value of the specific catchment area. The source of data is a digital elevation model.

For user convenience, data from a conventional (vector) CIS can be displayed on a raster relief map, so that geoecological tasks are decided by the user immediately on the terrain plan, and several variants of planned objects (hydrotechnical constructions, etc.) locations can by studied for determining the best one from them.

WATER OF AZERBAIJAN AND ITS RATIONAL UTILIZING

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In arid zones social-economic development of the country mainly limited by quality and quantity of water resources and ecological environment depends on conditions of water sources. Water resources of the Azerbijan Republic are limited and exposed to influence of technogene processes year by year. Sufficiently to note, that from 28 cub. of surface water resources 72% formed out of its frames (Turkey, Georgia, Armenia) and water resources distributed unequally on the area of the republic. Population of the republic (more than 7 mln.) not provided by ecologically pure water, there is keen water deficit in the cities (including Baku, Sumgait, Ganja and others), villages and deficit of irrigation water as well, square of irrigation areas more than 1353,8 thous, ha and it is foreseened to exploit 227,5 thous, ha of new irrigation areas until 2005.

resources of fresh subsurface water (SW) are also limited and established resources - 14,1, forecast - 1,2 mln m^3/day. Production per year for economy is 35-50% from its resources. the Republic's general water consumption is more than 14630 mln m^3/ year, 1313 from its - subsurface water (SW). In general, requirement in fresh as well as irrigation water is not met, if we taking into consideration that ecologically pure water used for domestic purposes at first, than arise the problem of the overdistribution of water resources. Therefore, distribution of pure water should be on the "Complex scheme of rational utilizing and protection of SW" basis. Including the requirements of all industries is proposed the following system of SW resources management.

Object of management.

Field of SW	Water objects

Indexes of management.

Exploitational resources, conditions, admitted levels, quality, requirement in water.	Requirement in water of the object part of SW in water consumption.

Methods of management.

Organization of a) Center on data collection and processing; b) observation netwok in the zones of water resources. Sormation and water intakes to fix the changes in SW regime. Forecasts of change of hydrodynamical and hydrochemical indexes: a) current, b) long term.	Regulation of water delivery taking in consideration regime of water intakes, don't permit the exhausting of SW.

Ways of management.

Creation of zones of water protection SW resources.	Operative regulation of water tion and artificial restoration of intake and water run-off infiltration systems.

SPECIFICITIES THAT CHARACTERIZE THE CIRCULATION AND QUALITATIVE CHANGES IN WATER OF THE DON DELTA

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The mouth area of the Don river including the lowest stretch of the river itself and the Taganrog Bay is a buffer region for the migrating fishes. Its hydrological regime has certain peculiarities. The shallow waters at the head of the Bay gives rise to mainly one directional vertical currents from the surface to the bottom. The morphometric picture of the end of the Bay where the depth abruptly reaches 8-9 m is in fact the western boundary of the near-the-mouth off-shore area.

In the sea-like areas of the bay, both along the longitudinal central line and near the shores the currents are frequently non-uniform, i.e. they can be of double layer type. The river Don carries into the bay waters rich in biogens and freshwater zones are formed which possess a certain feeding potential for the fish fry. These zones are not static and their size depends on the quantity of the river runoff, the salinity of the sea and on the strength and direction of the wind.

As a result of the wind action drift currents are predominant in the bay (40% of the westerly direction) and only near the delta the runoff currents are observed (1.5 m/sec and more). At the exit of the bay the velocity of the sea currents is about 0.4 m/sec.

With strong winds the brackish water can go up the Don to the distance of 15 km. In such situations isohaline 8-9 % can nearly approach the marine edge of the delta. The penetration of the marine water into the bay can occur in two ways. In some cases this water is driven by the westerly wind, however, sometimes it is a result of the prolonged action of south-easterly winds which give rise to a compensational current along the shore. For example, in 1970-1974 which is a period of considerable rise in the Azov Sea salinity frequently a wedge of transformed Azov Sea marine water of salinity exceeding 2% was registered in the Bay near the Ochakov spit (the average salinity of this part of the bay is 4.4%). For comparison it must be indicated that usually the salinity near the spit is not high (not above 0.5%). In 1990-1994 the salinity dropped to 2% and such situations are now scarcely probable.

Due to high turbulence the river waters in the near the delta area are completely mixed up from surface to bottom. Even in the middle of the Bay insignificant vertical gradients of salinity are observed (0.2 -0.3% per 1 m). The index of the alkaline reserve which characterizes the metamorphization degree of the water coming here is reduced 4-6 times.

It should be noted that the northern off-shore area of the Bay is more susceptible to the effect of the Don currents compared to the southern area (in our view this is due to the Coryolis force), but this occurs only when the Don runoff is strong enough. In view of ever increasing consumption of the Don water the dynamics of the water circulation can become less pronounced but the overall character of this process, the causes and the general mechanism remain more or less constant.

ESTIMATES OF THE AGRICULTURAL FIELD WATER SUPPLY IN THE FOREST-STEPPE AND STEPPE ZONES

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The agricultural field water supply is determined by the value of the ratio ET/ETO, where ET is the actual transpiration (transpiration corresponding to the optimal soil water storage). This parameter shows to what extent soil water provide the development of the vegetation cover. If the parameter ET/ETO is equal to 1, it indicates, that the plants are well provided with water. If the parameter ET/ETO is below 1, it indicates that is takes place the drought. When the value of the parameter ET/ETO is decrease, the drought is increase. The evapotranspiration model with standard meteorological, actinometric and agrometeorological data (such as air temperature, air humidity deficit, net radiation, wind speed, precipitation) and leaf area index LAI is used to obtain ET and ETO. The parameter ET/ETO was analysed for large scale spatial trends over many years for the spring wheat fields represented by 45 agrometeorological stations of the forest-steppe and steppe zones (and partially outside their ranges) of the European territory of the Former Soviet Unon. Among these, for 6 agrometeorological stations reflected all variety of natural conditions of the forest-steppe and steppe zones the parameter ET/ETO for individual years within a period over 20 years was examined. The average value of the parameter ET/ETO under natural water supply conditions can be shown as sketch distribution map. The agricultural field water supply parameter ET/ETO varies from 0.8 to 0.3 These value indicate a rather low natural agricultural field water supply of crops in the forest-steppe and steppe zones. Interannual variability can be presented as probability curves and statistics (mean values, standard deviation and variation coefficients) of the parameter ET/ETO. The average squared deviation of this parameter varies from 0.15 to 0.20. The variation coefficient changes within a range of 0.20 to 0.38.

STATE AND REGULARITIES OF THE RIVERS POLLUTION OF THE MIDDLE OB BASIN

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During the last decades the role of the antropogenesis in the formation of the hydrochemical regime of the rivers becomes more acute. Such influence is manifested more evidently not only on small streams but also on big ones. The problem of a complex study of large river basins becomes actual. Since 1991 we conduct the researches on the complex study of the content of surface waters of the river Ob and its inflows. Doing this work, we have taken the water samples from the Ob in the area from the Tom outfall up to Strezhevoi, and in the outfall areas of the rivers Vasjugan, Tim, Ket, Tom, Chaia, Chulim, Parabel. Besides, we took the samples from more than fourty rangers on the Tom river from Mezhdurechensk upto the outfall, as from their numerous inflows. In the samples there have been determinated the contents of a great number of chemical elements (macrocomponents, heavy metals, rare and rare-earth elements, organic compounds and microorganisms). In some cases we have got the data for the first time for the rivers under study. A complex method of approach to the study of the quality of surface waters allowed us to reveal the following peculiarities of the hydrochemical regime of the rivers of the Tomsk and Kemerovo region:

- waters of all the studies rivers contain these or other polluting substances, the concentrations of which periodically exceed the fixed limited concentration. Practically everywhere the pollution of the rivers is observed on a number of organic compounds;
- the caracter of the pollution indicates the peculiarities of the industries arranged in the rivers basins. The more indicative are oil products and phenols. For the northern part of the territory under study there are typical high values COD, stipulated both by the natural swamply of the drainage area and by the influence of the industries of forest and oil producing complexes. In the southern part the character of the pollution is stipulated by the receipt of industrial waste (chemical, radiochemical, etc.), leading to the increase of pH values, the concentration of Fe, Na, Cl, some metals;
- the more polluted areas according to the number of classifications are arranged, as a rule, for the large populated areas and the places with concentrated industrial units;
- the influence of the antropogeneous and natural factors on the chemical content of the rivers water leads in some cases to the identical results that essentially complicates the study of the hydrochemical regime;

- the cases of the excess of limited concentration on the content of other chemical elements are observed more rare. The more frequent are the breaches for the concentration of iron , less frequently - for pH, for the concentrations of nitrogen compounds, etc. The areas of the considerable increase of the concentrations of the number of chemical compounds and elements, including rare, rare-earth and radioactive ones, were found in the low stream of the river Tom and in waters of the Ob (in the area from Kolpashevo up to Strezhevoi);

- there have been revealed a various directionality of the special change of the contents of macro- and microcomponents in waters of the large right and left inflows of the Ob.

The obtained results add the materials of Coskomgidromet and allow to get a more clear idea on the sources and the character of the rivers pollution.

ECOLOGICAL DEMANDS AND RESTRICTIONS WHEN DESIGNING, CONSTRUCTING AND OPERATING SEA AND OCEAN PORTS

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Sea and ocean ports are architecturally ordered systems of buildings and constructions dividing the water and overland hydraulically tolerant ecotone. The aquatorial part of a port makes up litoral and sublitoral ecosystems. The terrestrial part of a port forms overland ecosystems, a typeforming component of which is an overland phytocenosis. The ecological importance of a port is, consequently, determined by ecological demands and restrictions which show how a port effects both water and overland ecosystems as well as how these ecosystems respond to such inf luence.

The main ecological demands to be met by ports as a whole are to prevent destruction of water and overland ecosystems ajoining to them and to preserve functioning of ecotones divided by a port. The main ecological restrictions determining the ecological substantiation of the port construction and further operation are to reduce both weak and strong effects able to change the conditions and quality of water and overland habitats as well as the conditions and quality of life within their limits. Of significance as ecological risk factors when constructing and operating ports are the quantitative parameters gradients

of the activity of chemical and physical impacts that a port makes upon the environment, as well as the respective gradient network appeared when the above gradients are unified in space and time. Of particular bioecological importance are the quantitative parameters of gradients of the produced by a port (in air, ground, soil, water and bottom-sedimentary media) chemical contaminators migrational streams; diffusion gradients of secondary chemical contaminators produced by contact synthesis of the reactionally capable port pollutants with each other and with the products of biological and geochemical metabolism in the locuses of technogenic dispersion haloes; activity gradients of soil ground, water and bottom sedimentary self-purification; oxygenation gradients of air, soil ground, bottom- sedimentary and water media; activity parameters' gradients of primary and secondary pollutants sorption, desorbtion and resorbtion; activity gradients of physical fields (electromagnetic, electrostatic, sound, ultrasound, light, radioactive, temperature, vibrational, wind pressure); mechanical properties gradients of the ground-soil cover and bottom sediments in accordance with their erosion tolerance; watering gradients of the ground-soil cover and circumterrestrial stratum of atmospheric air; indicators gradients of soil-ground cover stability to flooding processes. The parameters needed for the ecological substantiation of the port construction and operation are as follows: activity of the processes of the disturbed ecosystem natural reconstruction and also reconstruction of the ecosystems abiotic and biotic constituents in time; space dimensions and activity of the natural biopathogenic zones manifestations (including those caused by fluid streams, natural radioactive emanations sources, magnetic anomalies, geothermal effects), seismicity, frequency of occurrence and physical parameters of landslides, quicksand's, mudtorrents, whirlwinds, storms, tsunami, floods, dust-storms, hot dry winds, draughts, overcooling and overheating, increase of atmospheric precipitation and solar insolations. The own significance at determination of the ports ecological influence have the parameters of the ecotones upper-level capacity as well as overland and water ecosystems ajoining the ecotones and restricting chemical contamination and tensity of physical fields caused by the ports activities.

ECOLOGICAL PROTECTION SYSTEM OF SEA AND OCEAN PORTS SURROUNDING NATURAL ENVIRONMENT AGAINST THE PORTS DAMAGING ACTION

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The necessary measures to conserve the natural environment, within the limits of which the sea and ocean ports industrial sites function, are substantiation, construction and operation of ecological protection systems. These systems are the purposefully created specialised multi-component ecologotechnical constructions, the elements of which are characterised by ecological protective specificity and changability. As the complete wasteless and ecological safety are impossible, the ecological protection systems are designed to reduce ecological danger and by this means to conserve the genofund, phenofund, ecotones fund, population fund, cenofund, biotopes fund, ecotopes fund and ecosystems fund. The base of the ecological protection system construction is a complex of 18 chief successive components holding the barrier significance. These are as follows:

1. drainage network depositing, binding and desactivating chemical contaminators of ground and soil waters on the basis of absorption, adsorption, chemosorption, adhesion, appearance of incorporation compounds, formation of compounds insoluble in fats and water and their decomposition to the products included into geochemical and biochemical metabolism;

2. surface and bottom ground and soil liquid-phase chemical cleaning network using electrokynetic and other mechanisms of redistribution in space, accumulation and desactivation of chemical contaminators;

3. surface and bottom ground and soil polymeric film cleaning network using the mechanisms of molecular assembling and sorptional effects;

4. covering by artificial granulated grounds and soils using ceolytes and permutytes, molecular sieve effect, ionic exchange and filtration;

5. network of regular distributed pointed ground and soil organic, mineral and organo-mineral fertilisers using the specialised self-destructing fertilisers of the programmed operation time, limiting allelochemical soil fatigue and allelochemical pathogenesis;

6. network of artificial ground and soil drills-mineralising collectors, used for the controlled processes of liquid-phase and solid-phase (sublimying as well) wastes mineralization;

7. network of glazing, bituming and cementing stations providing for liquid-phase waste's hardering;

8. network of local contrary regulated air streams sedimenting airzoles;

9. network of local regulated fronts of air cavitational sedimentation using the combination of turbulization and cavitation;

10. network of parter one-year and many-year grass plants, absorbing, acuumulating and disactivating chemical contaminators out of ground, soil and water media, using the mechanisms of transcuticular and transstomatal respiration as well as active and passive transport along the conductive system;

11. network of multirowed rabatko-like plantations- biocidal sanators, chemical sanators and physical sanators;

12. network of courtine grass, shrab and tree plants- efflogenizers which are the producers of immunodeviators and adaptogenes;

13. network of high-trank bushes and trees acting as mechanical sanators, de -dusting the higher strata of circumterrestrial mass of the atmospheric air and creating behind the trees the sedimenting cavitation effect, using trichomal cover and microrelief of laminae' cuticular cover characterised by adhesive and sorptional activity and hydrophilia effect;

14. net of ribbon-like trunk multirowed moss plantations using sedimentation mechanisms of airzoles and vertical filtration of its liquid-phase components;

15. network of mast scrubbers, multicyclons and other air-purifying devices;

16. network of corrosion inhibition stations and salt sedimentation using complexones;

17. network of over-ground and under-ground stray currents fields blockators;

18. network of double-sided filtering chemosorbing water purifying dams in the surf sublitoral and litoral zones.

The ecological protection system constructions component, creating the barrier complex, are complementary, they function simultaneously, and increase mutually each other's effect. Thus, the ecological protection system is the functional constructive whole.

HYDRAULICALLY TOLERANT WATER AND OVERLAND ECOTONE WITHIN THE SEASIDE NUCLEAR POWER PLANT SITING ZONE AS A CHEMOPROTECTIVE BARRIER

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Water and overland space ajoining the seaside nuclear power plant siting area is an interphase space, which is equally characterised by parameters and properties of the overland soil and ground solid-phase media, water liquid phase and bottom ground sedimentary transient liquid- and solid-phase

media. The difference of phase state and diachronic variability of chemical, physical, chemicophysical, physicochemical as well as of colloidal parameters and properties of each media, dependant upon annual microclimatic and hydrometereological rhythms, are constant, that determines the extremeness of conditions and qualities of the given space as the habitat and living millieu. This millieu is ecologically significant as a function of the ecotone with various seasonally inconstant biotopes. Habitation of those as well as multitude of forms and life expectancy in these are determined with the help of acclimation mechanisms by two major parameters, namely, by water levels and water wave movement. The quantitative data of those two parameters vary depending upon overwaving water masses' volume dynamics, water level increase speed, turbulent process activity, when water level increases, and reached level keeping time. The above-mentioned mechanism action results in building up a specific ecosystem within the given space, the most important parameter of which is hydraulic tolerance. The tolerance biotic stabiliser is appearance and conservation of hydrophytes' rhyzospheres, which create in space interpenetration a sod system which is stable at water mass wave movements. This sod system holds together and unites in a single continual whole the superficial coastal layers of the bottom sedimentary cover and the superficial circumaquatorial layers of the soil ground cover. The sod system forming simultaneously both in pelosphere and in pedosphere is a medium for pelopedo- bionts and rhyzohydrobionts when there is a multitude of redistributing water masses encouraging laminarization. Hydraulic tolerance is in particular important within the zone of water- overland space limited by water-escape streams. The main ecological risk factors for a hydraulically tolerant ecosystem are as follows: cavitation effect, agregation and disagregation, granulation and disgranulation of mechanical particles, mealing, local sedimentation, desorbtion of pollutants out of the circumaquatorial soil ground cover and bottom sediments, pollutants redistribution by the broken overall waves within the zone of the multiple turbulizors' localisation, appearance of the pollutant concentrational gradients, the contact abiotic synthesis and biosynthesis of the most dangerous pollutants (e.g. algotoxines, aphlatoxines, and N-nitrouscompounds in circumaquatorial merocenosis.). 'The mechanisms determining the conditions of life and bound with them ecological risk factors define, firstly the ecotopic differentiation of the ecotone space and, secondly, the ecotopic selection of species and their populations stably reproducing within the limits of ecotone. The selection results in the organisms gaining the properties of everytopeness (an ability to exist in various irrigating conditions). It also results in biocenosis formed mainly by cianobacteria, microalgae, Lemna, Phragmites, Scirpus, Acorus, Typha, Sagittaria, Salix species, water nematodes, hirudilea, rotifers, gastropods, crustaceans, insects. It should be noted that stalks of tall-stalked hydrophytes serve as local turbulizers, and floating leaves and lemna colonies help laminarization. Ecotone as a whole acts as a stable double-sided ecological barrier. This barrier being included into hydrochemical, pelochemical and biochemical metabolism absorbs and transforms chemical pollutants scattered by the tidal water masses, as well as by ground and soil waters, waste waters and rain streams.

The above-mentioned function of hydraulically tolerant ecotones is principle as it limits penetration of, firstly, technogenic pollutants into sea waters and, secondly, tidal waters pollutants into surface grounds, soils and ground waters. Destabilization of a hydraulically tolerant ecotone may be induced by the considerably increased wave pressure bound with sea transport movement and with spontaneous movement of' big water bulks in sea media.

OCEAN AND SEA POLEMOECOLOGY: CONTENTS AND PROBLEMS

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Ocean and sea polemoecology is an independent division of polemoecology dedicated to establishing regularities of ocean and sea ecosystems' transformation influenced by the damaging effects bound with military warfare and terrorist acts. It is a division of ecology bordering at the cycles of Earth sciences, life sciences, physico-mathematical sciences, chemico-technological sciences, technical and military sciences. 'The basic problem of ocean and sea polemoecology is an analysis of reversible and irreversible disturbance and restoration of conditions and quality of the water media, bottom grounds and sediment as a habitat, as well as of trophodynamic chains, biocenosises and ecosystems appearing and functioning in oceans and seas. The specific feature of the ocean and sea polemoecological processes and phenomena is a dependence, primarily, upon chemism, electrical and magnetic fields, light pellucidity, thermics, vibrational state, acoustics and hydrostatic pressure characterising water masses. The polemoecological processes chiefly manifest themselves in changing the conditions and directions of pollution selection, cenogenesis and ecosystemogenesis (with the account of hierarchy from nanoecosystems to megaecosystems) as well as in increase of their dependence upon the values of physical and chemical similarity numbers, which determine the acclimation effect, population segregation and variety of biotopes, ecotopes and ecotones. Local changes in ocean and sea states as life

arenas, depending upon disturbance of their physical and chemical similarity parameters during warfare and terrorist acts, deform the lace of the hydrobionts and pelobionts areals and restrict an opportunity of their populations reaching the optimal biological mass. Of the extreme importance for hydrobionts and pelobionts are displacements of the gradients of dischemia, disoxigenation, diselectria, dismagnetism, disthermia, disphotia, disphonia, disradiation, disvibration, dishydrodynamia and dispelodynamia. Those result in the long-term and widening in space four-dimensional chain branching disturbance processes of conditions and effectivity in communicating visual, chemical and tactile information, which in turn provides for inter-organism, inter-population and inter-species communications (that leads to depopulation). The short-term changes in the water media chemical composition due to contamination by chemical transforming compounds (on the base of the contact synthesis as well) is the most dangerous depopulation mechanism based upon so-called sudden dying off ("sudden death" effect) occurring mostly in dominants and edificators populations. Dying off results in appearance of merocinosises with organic decomposition products containing chemical contaminators. Merocenosises are the secondary dischemia sources in ocean and sea ecosystems caused by warfare and terrorists acts.

The bioecological essence of changes in the ocean and sea ecosystems under the conditions of warfare and terrorists acts depends upon the seashore distance, seasonal nature rhythms, wave activity, the water mass stratification, depths, the masses and bottom sediments (pelosphere) abilities to chemical self-purification, structure and sorbtional ability of monomolecular interphase layer on water surface, mass and energy exchange between the water and air media. The water ecosystems parameters (changing mainly when disturbed) are as follows: qualitative and quantitative composition of contaminators (soluble and insoluble in water) , isotopia, energy, dimensions, structure and localisation of stream, wave activity, turbulence intermixability of water masses, quantity, volume and granulometric composition of mechanical particles, water surface purity, sedimentation intensity, taxonomic, systematic, sexual and age composition, biological mass and structure of living population, vital forms interrelationship, number and polylinkage of water and bottom food chains.

The chief problems of ocean and sea polemoecology are as follows:

1. establishing the ecological systems disturbance and ecorestaurogenesis regularities (that is mainly important for litoral and sublitoral);
2. purposeful differential increase of water, bottom and circumaquatorial ecosystems polemotolerance;
3. substantiating and constructing differential complexes of ecological protection for water, bottom and circumaquatorial ecosystems;
4. space localisation of ecological disturbances and decrease of their appearance time;
5. restricting the damaging impact of the disturbed water, bottom and circumaquatorial ecosystems upon the overland ecosystems.

PRINCIPLES OF OCEAN AND SEA COASTS' SPACE REGIONING WHEN SUBSTANTIATING AND PLANNING THEIR UTILIZATION

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Principles of space regioning are the demands and regulations which are significant as rules when territories and aquatories are charactorized aiming at established their geonomic importance and utilization opportunities. A coast is a geomorpholologically isolated overland space, within the limits of which talassogenic and telogenic fields mutually influence upon each other and hydrochemical and pelochemical metabolism processes interrelate. There is also mass and energy exchange between the water and overland media. Coasts' regioning is a condition of their utilization in more than 20 lines: as a water source, sources of minerals, civil construction materials, salts and bottom organic sediments, as territories for erection and operation of ports, water transport moorage, for construction of the sea-shore industrial enterprises as well as of tidal and nuclear power plants, dams, light-houses, hydrometereological stations and pipelines, making up the rest-zones with beaches, solaria, sanatoria, resorts, medical and rehabilitation centres, sports organizations, for the coastal cultivation of cultural plants and forests'arrangement, for aquaculture, for conservation of circumaquato rial overland and underwater landscapes, ecotones, biotopes, biocenosises, spawning-grounds, animals^migration ways, etc.

The most eesential integral and differential space regioning principles may be united into two categories, namely, natural scientific and applied principles. The natural scientific integral principles are as follows: 1. landscape-researching, 2. geosystemological, 3. ecosystemological (with the account of real and potential bioecological risk to abiotic, bioinert and biotic ecosystem's components), 4.biocenotic (with the account of real and potential danger to ecosystem and biocenosises' ability to conserve and reproduce when sujected to damaging actions), 5. trophodynamic, 6. faciodiagnistical, 7.georphythmological (with the account of repeating and reproducing those processes and phenomena which cause ecological danger appearance and manifestation), 8. chorological (arealological), 9.biotopical (with the account of biotopes^ abbilities to

provide for normal organisms^development or to cause pathological phenomena in them), 10. nosographical (with the account of number and variety of pathological phenomena in plants, animals and human beings), 11. geopathogenic (with the account of physical fields and geochemical metabolism activity, dangerous for various forms and manifestations on life), 12. ecotolerant (with the account of tolerance to damaging physical, chemical and biological actions of abiotic, bioinert and biotic ecosystems' components), 13. ecorestaurogenic (with the account of soil and plant cover's as well as of animals' ability to self-restoration and self-purification).

The main natural scientific differential regioning principles are as follows: barometrical, gravimetrical, gypsometrical, geomorphological, microclimatic, metereological, sedimentological, thermometrical, insolational, hydrometrical, hydrological, aeronomical, pedological, pelological, psammological, geochemical, mineralogical, geophysical, lithological, tectonophysical, seismological, radiometrical, geomagnetic, geoelectrical.

The cheif applied regioning principles are the following: sozological, geotechnical, hydrotechnical, hydroindustrial, energetical, timber-industrial, fish-industrial, aquacultural, agricultural, galurgical, curortological. In each specific case various regioning principles are advisable to combine.

The most important target of coast regioning is to prevent possible ecological incompatibility, firstly, between different industries which, when united in space, may bring about ecological emergencies. Secondly, between industries and the natural environment as the latter nay turn out to be not ecologically tolerant and may be cheracterized by processes and phenomena that could increase ecological danger of some technologies and industries. In this context it is quite important to carry out ecological certification of coasts.

THE QUESTIONS OF BUILDING WATER AND SALTBALANCES OF BASINS THE ARAL SEA'S RIVERS

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For decision of the Aral Sea basin's problems we must formulate next demands to construction water and salt balances of the separate rivers basins:

- distinguishing balance's elements which can reflect both physical picture of the movement the water and salt masses and the factors of influence over their changing (for example reservoirs and water-sheds);
- to correspond to real structure of wateruse system to take into account the possibilities of receipt the initial information and calculatable parameters on the base of exist forms of accounts and observations;
- to use the methods, dependences and correlation's, which provide not only reality of receipt final results, but let to estimate at numeral meanings' errors of water and salt balances;
- the base components, the indexes of calculation have to take shape which will be understandable for engineering and economical analysis in order to further coming to some decisions.

There is a considerable experience of building water and salt balances in the Research Institutes of the Central Asian States.

For the analysis of real wateruse conditioned and prognosis of changing their components in order to basic concrete decisions. In the Research Institute "Sredazgiprovodphlopok" these elaborations in the served by foundation for receipt of decisions in the "Schemes" of the complex use and environmental of water resources the Syrdaria and Amudaria rivers' basins.

they serve as daily tool for the operative and long-term management of the water resources in such organizations as Production Union "Vodproekt" and Interstate Water Reservoirs Union of "BVO Syrdaria".

This report includes the principal systematic methods and results of composition of the water and salt balances on the Syrdaria river basin, as an example.

IOINDICATION OF OIL POLLUTION OF RIVER WATER (MALYI IFGIZ IN THE LOWER POVOLGIE AS AN EXAMPLE)

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Biotic complexes of water-surface ecotones are functioning as membranes and are indicators of water pollution. The most sensitive indicator is a complex of zooperifiron which is an independent invertebrate community, composed mainly by inhabitants of water plants. Oil Come to Malyi Irgiz (one of the left Volga tributary) from broken pipeline. The analysis of the zooperifiton reaction was held there on shallow water. The zooperifiton of Malyi Irgiz includes 55 species. It was noticed that in clean

water there are 17 classifies of animals. At the same time in a dirty place there are only 11 of them because of disappearing of Protozoa, Izopoda, Acaridae and Dreiessena polymorpha. Sida crystallina. Nematoda, Hydroptilidae (Agraylea, Orthotichia tenillis, Phryganea, Ntianodes) and Cladocery are also very perceptible to the oil pollution because their strength decreased in the polluted place. On the other hand, Amphypoda (Corophium curvispinum, Cikerogammarus Heamohaphes) and Copepoda turned out to be very resistant to pollution. The number of copepoda increased from 45 pieces/sq.m. to 893 pieces/sq.m. The number of Hydra vulgaris and Oligocheta also increased highly. But the number of Copepoda on the underwater plants (Potamogeton pectinatus, P.compressus, P. perfoliatum, Ceratophyllum demersum, C. submerssum) differs much in different age groups. The number of Copepoda on the plants of Potamogeton is 371 pieces/sq.m. in dirty water in comparison with 1355 pieces/sq.m. in clean water. Our observation shows the possibility of using zooperifiton communities as indicators of water pollution by oil.

PROTECTION OF WATER BODIES FROM PETROLEUM PRODUCTS

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An increase in use of natural water bodies for drinking water production and fishing industry imposes heavy demands on the quality of sewage entering water bodies. A great deal of pollutants arrives at water bodies along with surface sewage. Characteristic of surface sewage pollutants are petroleum products which are washed by rains or thawed waters into water bodies from industrial territories, populated areas and other territories where automobile transport is running. Petroleum products of sewage are in the soluble and emulsifiable state, Their concentration ranges up to 5-10 mg/l, at the same time the petroleum concentration in sewage that is to enter water bodies for fishing industry may not exceed 0.05 mg/l. Therefore it is necessary that the surface sewage should be locally treated before entering a water body. At this treatment, the removal of soluble petroleum products is the most difficult stage. Sorption is practically the only method which enables to develop cleaning of petroleum products from sewage to any required point without polluting by secondary components. The advantage of the sorbing treatment over all other methods of profound treatment of sewage is that it may be carries out at relatively small concentrations of the sorbate and may ensure almost total extraction of the components. The most typical sorbing system is the filtering system with the fixed layer of the sorbent. The filtering charge serves as the main working material of filtering plants. The multitude of substances of natural and artificial origin may be used as a filtering charge in the absorbers for treating water for petroleum products. In deciding on a filtering material, if is necessary to consider not only its sorbing activity but material cost, feasibility of its winning in the area where the plant will be built, its mechanical robustness and chemical stability toward filtering water, as well. As a result of the studies made, a readily available material of natural origin which is validly sorbing petroleum products has been chosen. Sorbing properties of the proposed sorbent have been studied, the toxical estimation of the sorbent has been performed. Pilot-industrial tests of treating surface sewage of automobile transport station have been carried out using the proposed sorbent as a filtering charge to achieve the water quality which permits disposal of the treated sewage into a water body without damage to fish.

STATE POLICY OF THE STABLE WATER-USE IN RUSSIAN FEDERATION

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1. State water management policy is based on the fact, that water management, from one hand, is a resources-providing branch, and on the other hand it is a leading nature-protective branch. Water - is the main part of the whole economy-management complex and the main component of the nature - the base of our life. Because of it the strategy of water resources management should be based on the system mechanism, which stimulates ecology-safe use of the water resources, in other words - stable water-use.

2. As far as it is impossible to solve quickly all the water management problems, the state policy is based on the principles of the pointing out the

strategy goals (on which the whole water management policy is oriented) and the goals of the transmission period.

Strategy goals depend on the main water interests of the society, the implementation of which will allow to solve water management problems, to liquidate the water contrariety in solving social-economic problems.

3. The policy on implementation of these strategic goals is based on the following conditions:

- minimizing of the water-use and polluted substances' disposal;
- prevention and precautions;
- a water-user should pay;
- cooperation and unity of efforts.

4. One should plan, form and manage one united social-economic system of the river basin by means of the impact on the basin water-management complex with the help of united basin water-management system. Management is based upon the combination of the basin ecosystematic principle with the administrative-territorial one.

5. The common goal of the basin water management consists in the fact that there should be provided the stable water-use, there should be reached ecology-safe stable state of the water resources, there should be preserved and developed healthy water ecosystem, which will provide continuous life of the population.

6. In accordance with the policy, goals and tasks, we should reconstruct the whole system and the structure of the management, and the goals of water-management structures should be strictly divided into purely managing and economy-providing.

ECOLOGO-GEOGRAPHICAL ALTLAS AS A MODEL-PROGRAMM EXPRESSION OF CONCEPTION OF BALANCEDAND STABLE DEVELOPMENT OF A REGION (OF THE EXAMPLE OF THE REPUBLIC)

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Periodical moral aging and renovation of technologies forms cycle recurrance of socio-economical development, and its character and peculiarities are the main source of ecological changes.

On the present stage of ecologization and informatization the intensive way of socio-economical development means gratual transition on the way of balanced and stable development in global scale.

Imperatives of stable development require formation of new mechanisms of managment in global,national (federal) and regional scales, new policy of ecologo-ecocnomical sense.

The main task of the ecology nowadays can be defined as a problem of studing processes of exhaustion of vitally important resources, their distribution among human population and elaboration of methods of preservation and distribution favouring prolongation of life-time of human civilization. In this regard, corrected programs of socio-economical, ecology-economical, informational, etc. development and recreation at the level of global, federal and regional scales schould begin to work, in order to elaborate general ecology-economical policy by means of conception of balanced state and stable development of a region.

As a model expression of the conception becomes " Complex ecologo-geographical atlas of a territory", providing, integral, complete and balanced views of the environmental condition.

In the Tatar Republic Institute of Ecology of Natural Systems of AST appears to be a coordinator of atlas preparing, and informational, cartographical and computer modelling is conducted by state Committe on Economy (Program "GIS of Tatarstan").

WATER FACTOR IN THE DEVELOPMENT OF ST.PETERSBURG

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Surface water-rich surroundings are a specific feature of the St.Petersburg natural environment, and the water system Ladoga/Neva/Neva bay/East part of the Finn Golf is the main component in the city development.

Creation of this "window to the Europe" had required great efforts. Being one of its main planning elements from the moment of the appearance of the city on the Neva banks, the river had obtained its reward: the magnif'icant embankments, the bridges, the architectural ensembles while the sea panorama remained quite unattractive. Nowadays, due to the change in the geopolitical situation, the theme of the sea gate for Russia obtained a new topicallity. It

is may be the present generation who will testify the ten times or more increase of the sea goods turnover.

In the actual general plan, the Heva bay is declared as the urban reservoir. At the same time, it is here where all the main city sewerage disposal system outlets are concentrated, what aggravates the really bad ecological condition of the reservoir.

The principal problem is that due to limited land resources in all the directions (except the west. side), the city should go to meet the sea. However it is the west part of the city that is needed to be protected against the sea element, against the so called "driven floods". This situation results in necessity of the protective complex constructing.

There are 69 water flows of the total length of 217 km and 6 large lakes having the total mirror area of 10 per cent of the city area. In addition to the surface water resources of 71 c. km, the subterranean stressed water is used for the regional water supply.

The resource of the former source is more than 100 c. km. There are more than 3000 boreholes in the region. The total extraction coefficient does not exceed 0. 23. nevertheless, even such the water extraction from the Gdov, Kotlin, Lomonosov, Ordovik and other water levels resulted in formation under St.Petersburg and its surroundings of the depressional crater of more than 200 km in diameter. But the control system for monitoring the water condition has not been created to date.

One should also bear in mind the ground water. Under such conditions as the excessive wetting, the high water-level during the great part of the year, the sewage outlet from the sewerage mains and due to close hydraulic interconnection with the surface water and with the subterranean water levels, the ground water itself can be as notice source of the pollution.

Unfortunately this is not only! The current events, in particular, the attack of the water-impregnated rock upon the metro railway, stimulated raising the problem of the safety of a "solid" supporting our city which assimilates more and more the subterranean bulk.

Solution of these problems in the city development is an object of the further scientific researches as well as the practice of the water-using in St.Petersburg. It is obviously that only a common approach to the governing the water resources can provide the necessary optimum in our water system.

The efficient solution of the problems indicated above is restrained by the lack of the structure coordinating the water-using activity in the Neva river basin.

INFLUENCE OF THE VOLGOGRAD RESERVOIR ON THE BIOCOMPLEXES OF THE VOLGA FLOOD PLAIN

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River flow is the base of the existence and development of river basin as integral runoff biogeosystem. This system is characterized by unified genesis and the original complex of flood plain ecosystems, which interacts both with river and with cathment area. The state and dynamics of the land ecosystems and the biotic communities of water-land ecotones at flood plains depend mostly upon the hydrological regime of river and the gydrogeological regime of territory. Therefore, the regulation of flow by dams and the creation of storage reservoirs on the rivers change greatly the state and dynamics of flood plain ecosystems. The biggest storage reservoirs on the rivers of Caspian Sea and Black Sea drainage basins are situated in European Russia (19 storage reservoirs with total water volume of 228.7 km^3). Their water area totals 29.6 km^2 due to the plain character of river valleys.

One of the biggest reservoirs on the Volga is Volgograd reservoir. the territory of its water surface is 3117 km^2, its full volume is 31,45 km^3, 107.0 thousands of hectares of pastures and grasslands; 70.2 thousands of hectares of forest and bushes; 30.4 thousands of hectares of agricultural lands; 61.7 thousands of hectares of other lands gas been flooded by waters of this reservoir; 269.3 thousands of hectares - total. Construction of this reservoir cased to life changes in biocomplexes of the flood-plain.

In the upper pool of the hydrosystem the hydrogenic successions of vegetation develop due to the effect of Volgograd storage reservoir. Here, the cenogenesis role of willows (Salix alba, S.Triandra and Populus nigra) grows. At the same time, the area of young oak forests (the communities: Quercus robur with Ulmus laevis; Viburnum opulus, Rubus caesius and Convolaria majalis) decreases.

Now, the aridization is well expressed down the Balacovo hydrosystem due to the shortening of floods. Owing the this, such species of steppe flora as fescue - Festuca sulcata, cove-colored Koeleria - Koeleria glauca, Austrian Artemisia - Artemisia austriaca, and ruderal species enter the meadow communities of flood plains and so reduce the quality of herbage.

We discovered the steppe rodents (green hamster - Cricetulus migratorus and big jerboa - Alastage jaculus) on the degrading flood plain meadows in Saratov region. This fact attest to the steppening

of the Lower Volga flood plain due to the disturbance of flood regime.

Aquatic-terrestrial ecotones, i.e. the contact areas between water and land, are the zones of the most active development of biotic processes, the concentration of organisms, and the increased biological variety at flood plains. The disastrous changes in the biotic communities of aquatic-terrestrial ecotones (the death of sessile organisms, zooperiphytons, and the preimago stages of insects) occur intermittently as the result of the disturbance of hydrological regime especially during the anomal lowering of water level due to the operation of hydrosystem.

MANAGEMENT OF WATER RESOURCE SYSTEMS UNDER CONDITIONS OF RISK AND NON-STATIONARY

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A water resource system (WRS) is a complicated system with a lot of parameters and relations, determining its operation and development, complex interrelationship between its subsystems and between the system itself and other natural and economic systems. All WRS parameters vary with time; WRS processes and external impacts, affecting it, are uncertain and stochastic. Therefore, methods of WRS management is based on the general principles of managing complex systems, taking into account peculiarities of a certain WRS and some simplifying assumptions.

One of these simplifications is our idea on the stationarity of WRS operation and development. It is true for WRS, whose connections with natural and socio-economic processes are weak under inconsiderable impact of economic activity on WRS. Till recently practically all the existing WRS fell under this definition. Intensified economic activity caused the necessity in analysing WRS development and operation under non-stationary conditions.

The strategy of rational water use under conditions of risk, non-stationary, should be based on a compreheensive study of WRS as dynamic manageable systems. Some of their characteristics were studied under stationary conditions. Some of them were assumed realized or negligeable and not worth while studying. However, under non-stationary conditions these properties may turn out televant and they should necessarily be investigated.

Different models, including the ones of WRS operation and development under stationary conditions as particular cases, should be regarded as a means of WRS investigation and elabortion of rational water use strategy under non-stationary conditions. The paper presents one of such models, in which the methodology of decisions-making on rational water use and water quality control is realized, asing on the idea of quaranteed water yield under risk-prone conditions.

A flow description is realized in the model. It assumes the WRS presentation in a form of a graph, whose geometric configuration corresponds to the scheme of simulated system. A set of vertices corresponds to the location of water sources, reservoirs, river and canal junctions, water withdrawal and returning facilities. A set of arcs corresponds to water users and reaches of rivers and canals. The amount of water and pollunats in the WRS elements are presented in a form of corresponding flows. Optimum WRS operation is described by the task of determining optimum flows at network.

The problem of optimum WRS operation is a two-staged task of stochastic programming, where strategic variables of the first stage, selected under unknown concrete realizations of stochastic conditions, are guaranteed flow values in arcs and water volumes in depots, which simulate assigned water and pollutant quantities. Tactic variabless of the second stage, selected under known realizations of stochastic conditions, are arc flows and depot storages, corresponding to the amounts of water and pollutants, entering the WRS and leaving it.

The problem is to minimize the non-convex function on non-convex (due to the non-linearity of constraints) set of equalities. There are no general method of solving such problems. However, the specific character of the problem under review (general separability of the task function and the bilinearity of constraints) allows us to solve it with the error, not exceeding the assigned one. In this method the determination of the optimum vector of the problem, is reduced to the solution of a finite set of evalutional task of convex programming, based on forming convex covers for certain task function items and constraints for a system of constricting sets.

The solution contains in an implicit form the determination of optimum (assigned) puobability, the latter being regarded as the probability of belonging of realized operation regimes to the set of favourable ones. Here different types ofassigned probabilities correspond to different types of water use.

WATER RESOURCES MANAGEMENT: PAST, PRESENT, FUTURE

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Water, the essential natural element, stimulates the entire chain reaction of biological process, fundamental life supporting resource, and the only renewable natural resource put to re-use through re-cycling process, today, unfortunately fall a prey for gross misuse and abuse by the mankind. With the rapid industrial growth the general perspective towards this resource is changing. In the era of technological development, urban and industrial growth, no more this natural resource is regarded as "Social need" but as "Economic Tool" in development process.

The early and mid decades of 20th century, the challenge before everyone of us was to combat with "Bacterial Contamination". Whether this challenge was properly met or not, in the recent decades the claim made by international agencies to provide safe drinking water and environmentally sound sanitation utterly failed despite scientific knowledge and technology. In fact, we proudly declared the decade 1980-1990 as "International Decade of Safe Drinking Water".

However, the world is still struggling to eradicate the sources of bacterial contamination which was proved the cause for 60% water borne diseases in the world. Further, in last leg of this decade, the world experienced radio active contamination in drinking water. In these circumstances, soon we are stepping into 21st century, a shift from industrial society to electronic society, and probably with much more complex problems in water management.

With the growth of population, technology and agriculture and consequent changing life styles influenced multiple uses of water. This very multiple use of water simultaneously, paved way for multiple sources of contamination, bacterial, thermal, solid waste leaching, heavy metal concentration, accumulation of carcinogenic elements, and lately, radio active.

Today, we are able to provide 4,00,000 gallons/ day for a distillery industry, justifying the need for economic growth. But at the same time, we are forced to delete several habitations from getting access to safe drinking water supply. The water resources in this natural form as river courses, which were regarded as life line for entire biological and cultural diversity, today turned into subjects of social conflicts.

The purpose for which the reservoirs/dams were built longback, today are failing to meet the targets either of irrigation or power, posing the question on the very "Renewable Nature" of these structures.

Across the countries, no clear policy has emerged and no peoples mandate was asked for on the use of these resources. Even to this day, in the throes of water crisis, technocrats and engineers dominate the mechanisms of control of water resources who emphasize on development and side track the sustainable management.

The consumers forum's also failed to identify and recognise that every 'living element' on this planet is a "Water Consumer". Mostly, and unfortunately whenever the debates arises on water consumers/ users, it gets limited to two major social sections: farmers and industries.

This paper attempts to furnish on the growing conflicts, lacunae in policies and legislation and tries to provide possible alternative interventions in the field of water resources and its uses within the frame work of the need to tap and encourage local wisdom, blending it to contemporary situations, with the usage of certain case studies in Andhra- Pradesh, India.

WATER QUALITY STANDARDS AND OBJECTIVES IN RUSSIA: PRESENT STATUS AND OUTLOOK FOR THE FUTURE

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Standards, regulations, provisions, rules, and guidelines enforceable in the Russian Federation regarding to water quality requirements are commonly based on the concept of Maximum Admissible Concentrations (MAC) and Approximate Allowable Levels (AAL) set up for a great number of substances and compounds occured in aquatic environment.

Basically, the Russian standards and requirements do not radically differ from those applied in the International Community but their practical use in water conservation and integrated water resources management reveals certain difficulties caused by interagency/ intersectoral discordance and diverse interpretations.

The need for establishing an integrated system of water quality requirements in Russia and its harmonization in international aspect is getting priority along with water quality and water resources management issues within transboundary basins.

At present, according to the "General Provisions for the State System of Codes, Regulations and Standards of the Russian Federation" approved by the Government in 1992 all regulatory documentation is subject to be revised and harmonized with international standards.

The Water Quality Standards and Objectives Study being implemented in the framework of the Federal Program of Coordination of the Water Quality and Water Resources Management Component of the Russian Federation Environmental Management Project financed from the World Bank Loan, is aimed at attaining the following overall objective:

- recommend to the Government of the Russian Federation, and interested ministries, agencies and institutions for the design and implementation of a revised system for water quality requirements, which would be capable to support:

(a) regulations to enforce water management;

(c) the development of integrated water monitoring systems.

(b) the development of short-, medium- and long term policies and action plans to improve the quality of surface and ground water resources and the quality of drinking water.

The results of the Study will be tested in Pilot projects within the Upper Volga, North Caucasus and Urals Regional Subcomponents.

Water quality requirements shall have a systematic, logical framework aimed at providing consistent, compatible interlinkages and criterial background for the integral parts and functions of water quality and water resources management.

A contemporary internationally recognized concept for water quality requirements as defined in the Recommendations to the UN/ECE Governments (1993) is expressed in the form of water quality standards (criteria) and objectives approach.

Water quality standards (criteria) are defined as a set of numerical values of varying list of parameters, that reflect the best scientific knowledge on water quality, embedded in legal regulations and can be:

- mandatory for all water users and enforced by governmental authorities;
- guidelines that are also defined as numerical values of a list of variables (parameters), and have the character of recommendations (e.g. EU guidelines, WHO guidelines).

Water quality standards and guidelines should be used as a reference base for the assessment of the current water quality, its suitability for various purposes and as an ultimate goal for water quality management.

Water quality objectives, are set basing on economic considerations, present and future water uses, forecasts regarding industrialisation and development of agriculture, and many other socio-economic factors. They are being developed by water authorities in cooperation with other relevant institutions to set threshold values in water quality to be maintained or achieved within a certain time period and proved the basis for pollution control regulations and for undertaking specific measures for the prevention, control, or reduction of water pollution and other adverse impacts on aquatic ecosystems.

The water quality requirements system shall cover:

a) surface water, including sediments;
b) ground water;
c) drinking water;
d) effluents (wastewater);

Also, the following categories of variables (indicators) shall be taken into account:

- physical/chemical;
- biological
- sanitary/hygienic and epidemiological;

The system of water quality standards and objectives shall encompass a set of recommendations, methodological, technical and guidance documents covering issues outlined below :

1. Water quality standards (criteria)

1.1 Definition and functions of water quality standards (criteria).

1.2 Selection of critical variables (human health/ ecotoxicological risk).

1.3 List of numerical values of selected critical variables (individual compounds and aggregate variables).

1.4 Guidelines for the application of water quality standards.

1.5 Methodologies and standard procedures for the determination of selected variables, including detection limits.

1.6 Recommendations for analytical control (quality assurance/quality control)

2. Water quality objectives

2.1 Definition and functions of water quality objectives in integrated water management.

2.2 Guidelines for the establishment, assessment and revision of water quality objectives (regional river basin level)

3. Legal and institutional instruments

3.1 Definition of legal instruments to enforce compliance with water quality standards and objectives (water code, additional federal/ regional legislation)

3.2 Definition of responsible governmental, regional bodies and river basin authorities for enforcement and control (including permitting).

4. Information support

4.1 Definition of information needs

4.2 Definition of monitoring strategy

4.3 Definition of the responsibilities and role of key-institutions involved in monitoring

4.4 Guidelines for operationalisation of monitoring network

4.5 Guidelines for design, development and implementation of decision support systems at federal and regional/river basin level.

4.6 Guidelines for reporting and information utilization procedures.

The Study shall be carried out by the Task Force composed of Russian consultants, foreign con-

sultants and experts from Upper Volga, North Caucasus and Urals Regions. The scope of work for the Regional Pilot projects shall be defined in the programs designed by the Task Force.

It is envisaged that the Study will be completed in 1998 with revision of national legal, regulatory and guidance documents on water quality standards and objectives and their implementation and submission the documents to the government of the Russian Federation for approval and nation-wide application.

MANAGMENT OF WATER RESOURCES IN THE AZOV SEA BASIN AND THE PROBLEMS OF PRESERVATION OF THE SEA ECOSYSTEM

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Not so long time ago the Azov Sea was one of the most productive waterbodies of the World Ocean. Its small volume (320 km^3) and a very substantial river runoff (42 km^3/year) made it possible to preserve the sea as a brackishwater reservoir and ensured its high productivity.

The Don is the main river of the Azov basin, its runoff provided more than 67% of freshwater in the sea, spawning grounds of fluvial and migratory fishes were located on its bed and flood plain lands. Understandably, processes taking place in the Don affected the condition of the sea ecosystem.

In the Don basin a complex nature-related economic system has developed which includes all types of water consumption (communal, industrial, agricultural, water supply, fisheries, water transportation, energetics, recreation and so on as well as nature protection measures). Unfortunately, the preservation of the marine ecosystem received until recently the least attention. As a result, the natural reproduction of fluvial and migratory fishes of the basin was severly disturbed, the productivity of the Azov Sea reduced and the catches of commercial species biologically connected with the river Don have dropped by now by tens and even hundreds times. Some biota representatives which earlier were plentiful and commercially useful are not now classified as vanishing species.

The use of the water from the Don basin (including the Ukranian territoty) is characterized by the following main data: the number of water intake facilities from natural sources is more than 19th. (among them 6 thousands from surface sources) with the total volume of water intake being more than 17 km^3/year (15 km^3/year from surface sources). 917 water reservoirs are in operation in the basin (707 on Russian territory) with the total volume of 29.5 km^3 and 8 th.ponds containing 1.4 km^3 of water.

The Tsymlyanskoye reservoir is the biggest in the basin, reseiving water from 60% of the catchment area of the basin. Using this reservoir the river flow is controlled since 1952. Its total volume is 23.86 km^3, the controllable volume 11.54 km^3 and its surface 2700 km^2. Whereas earlier, according to estimates, 84 years out of 100 were characterized by water amount sufficient for spawning, now this fugure dropped to 15, the area of the flood plain land decreased from 95 to 27 km^2, while the duration of the flooding from 49-56 to 11 days. In the course of the last 44 years the water regime in the lower Don was satisfactory for the fisheries only in 1963, 1979, 1981 and 1994.

The water resources of the lower Don are presently used up to the limit. The volume of the water taken including the Ukrainian territory was in 1994 9.3km^3/year; the water discharge amounted to 5.2 km^3/year, 1.7 km^3/year of which were polluted waters. The pollutant agents were represented by fertilizers, pesticides, mineral oil products, phenols, salts of heavy metals, organic substances, they, too, produced an extremely detrimental effect on the functioning and productivity of the Azov Sea basin biota. Even this incomplete enumeration of the problems points to the urgent necessity of developing such a system of the water management that would take into consideration not only the economic needs of the water consumers but primarily the requirement to preserve the marine ecosystem.

In recent years such a system is being worked out, it will make it possible to analyze various water managment approaches and to carry out an operative supervision in accordance with actual conditions.

CANADA-UKRAINE ENVIRONMENTAL SITE ASSESSMENT AND REMEDIATION PROJECT

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The Emergencies Engineering Division (EED) of Environmental Canada (EC) is currently conducting a number of international initiatives related to the environmental site assessment and remediation of contaminated sites in the former Soviet Union. These activities are primarily funded by the Canadian International Development Agency (CIDA) with additional funds coming from EED, private sector companies and other sources.

The Ukrainian Site Assessment and Remediation Project (SARP) is currently the biggest project done by EED. Its main goal is to provide technical assistance in carrying out environmental remediation at former Inter-Continental Ballistic Missile (ICBM) sites and associated surrounding facilities in Ukraine. The objectives of this project are:

- to provide to Ukraine, Canadian techniques and equipment for continuing environmental assessment and remediation by training and equipping a team of engineers, chemists and technical personnel; and
- to give Ukraine the capability to establish its own training programs in the future using a cadre of Canadian- trained experts to introduce to and to train other Ukrainian environmental specialists in Canadian procedures and technology.

In this paper, technical capabilities and experience of both the EED and its industrial partners are described. Work progress to date and prospectives of future work, including potential cooperation with other countries of the former USSR, are discussed.

ECOLOGICAL PROBLEMS OF THE RETURNLESS REMOVAL OF THE SMALL RIVERS RUN-OFFS

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In modern conditions of the quantitative exhaustion and qualitative worsening of the water resources the general strategy in the policy concerning the water distribution system must be based on remaining the ecologically safe water utilization and supporting the natural balance in the water systems. For that it is necessary to reserve in the rivers a certain part of the run-off which should provide a normal functioning of the river ecosystems irrespectively of the kind of the economic activity. Such a run-off in the river should be considered as a naturally protected or as an ecologically required one. Depending on its value in the practice of the water distribution calculations there is grounded the volume of the river run-off free for its use and an acceptable level of the returnless removal of that.

The carried out reserches have shown that when aiming at prevention of the undesirable changes in the ecosystems the ecologically required run-off for a certain river is a variable value and it should be evaluated in all phases of the water regime due to the corresponding flow rates of water. The method for their determination is based on the principles of the system analysis and it provides:

- to remain in the river flow the hydrodynamic equilibrium observance of which provides the transporting ability of the water flow and a possibility of the processes of the watercourse formations;
- to create a favourable water regime for supporting the biological productivity of the water ecosystems providing a satisfactory sanitary state and conditions for the river self-purification;
- provision of functioning of the river ecosystems as the objects of the live nature.

In accordance with these clauses there were stated criteria limiting the ecologically required flow rates of water. The main ones among those are the following:

1. The watercourse forming water flow rates, the level of the water for its flooding the plain and for its flooding the plain with a layer of 10 to 15 cm within 5 to 7 days and nights with the following gradual falling down of the level.

2. The velocity regime of the water flow according to which there is presupposed existence in the river of the non-silting average velocities that ($v_{нз}$=0.1 to 0.25 m/s), velocities that prevent overgrowing of the watercourse ($v_{зар}$ = 0.3 m/s) and velocities mostly favouring creation of conditions for development of the kinds of phito- and zooplankton which are important for the ecosystem ($v_{фа}$ - 0.5 to 0.6 m/s).

3. Contents of the organic substances in the volume of the waste waters that come into the river, and the oxygen regime of the water flow.

There were developed graphical and analytical relations by using which one can determine the corresponding water flow rates regarding of each of the mentioned criterion, and on the ground of the resulting analysis one can determine the ecologically re-

quired water flow rates in separate phases of the water regime for a specially chosen river and run-off.

The ecologically required volume of the river run-off is calculated by means of the expression

$$W_{эк} = \sum Q_i^{эк}.t_i,$$

where: $Q_i^{эк}$ - the ecologically required water flow rate, m/s; t_i - time during which this flow rate is fixed.

The ecologically acceptable volume for the river run-off removal (the river run-off free to be used) is set on the ground of the difference in the values of the natural run-off and of that which is ecologically required one.

The results of the calculations carried out in accordance with the developed method have shown that for the rivers of Ukraine whose basins are situated in different natural onditions the ecologically acceptable volume of the safe removal of the run-off is 10 to 25 per cent of the average multiyear volume of the annual run-off. Observance of this condition remains ability of the water ecosystems of self-regulation, self-purification and self-reproduction.

ECOLOGICALLY SAFE RECLAMATION SYSTEMS FOR THE HUMID ZONE

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The scientifically grounded and technologically provided reclamation of lands was and it will be used as an insurance fund for the risk farming agriculture in the zone where the whole Ukraine is situated, nothing to say about the region of Polissia.

The reclamation systems of the humid zone of Ukraine covers 3.2 million ha of the agricultural area of the economic significance, including 1.1 million ha of those with a double-direction regulation of the water regime (drainage-moistening, drainage-irrigation).

However, the potential opportunities of the reclamation farming agriculture are still far from being used completely, and two main causes for that are clearly traced: insufficiant material and technical provision for the agricultural production, and, from the other hand, the technological reasons and the accompanying them ecological factors. The essence of the problem is that a highly productive reclamation farming agriculture orients on an optimal agro-technical complex where the basic element is the water regime of the soil. The technological schemes of the reclamation systems should provide their optimal regulation depending on the stages of development of the agricultural cultures and on the weather conditions setting.

The one-direction operating drainage systems (DSs) that nowadays perform taking away the water from the territory being drained and functionally correspond to their purposes in the humid and semi-humid years concerning the precipitation level. In droughty years in the active layer of the soil there is created a deficit of the prosductive moisture with all the negative ecological and economic consequences. In the same regime the drainage-mostening systems (DMSs) practically work, though their water conducting network is reenforced with a lot of water regulating structures that are accounted on the hand gear; the last point does not allow to perform in due time their regulation accordingly to a corresponding technological cycle. That is why such hydrostructures (HSs) are constantly open for drainage. The non-productive final discharge of water at the system amounts to 30 to 40 per cent of the water intake volume. Furthermore, an open regulating system on the irrigated fields, if not supplied with a water regulating equipment, works practically on the soil flushing. Together with the drainage flow the fields are deprived of almost a half of the mineral fertilizers inserted into the soil as well as of other technological chemicals.

The full technological cycle of the water regulation in the reclamation systems of the humid zone includes the following operations: drainage - drainage stopping - additional moistening - stopping to moisten the lands being drained.

Taking into consideration the continuing character of the technological process of regulation of the water regime of the lands being drained, as well as a significant distribution and the lineal extention of the open water conducting network , a large number of the water regulating HSs in it, to organize their purposely directed action with the aim to provide an optimal water regime is possible only by means of the hydrolic automatization, for it is the most economic and acceptable for the operative implementation.

As a result of a multi-year research we have developed a module for the automatized drainage-moistening system that maximally meets the set tasks. Its technological scheme comprises not only the technical solvations concerning both the structures of the automatized DMSs, but also three types of the automatized HSs which are protected by the authors' licenses No 1497350, 1672419 and 1807466.

Unlike the operating DMSs, water consumption at the DMSs is defined by the biological needs of the agricultural cultures and it is made according to the field request. The field informs the system of its technological requirements and of the turn and duratuion of each operation depending on the dynamics of the ground waters levels and on the specified humidity of the active layer of the soil which are adjusted correspondingly to the phases of the vegetation development of the plants. The hydraulic

automatization, together with the corresponding constructive changes concerning the DMSs, increases their technical capabilities, makes them technologically controlled. In such systems the closed regulating network is run-through; all the constructive elements have the straight and backward hydraulic connection. The water distributional HSs in the open water cunducting network and in the closed regulating network are supplied with the corresponding hydroautomatical equipment.

The parameters of the constructive elements of the automatized DMS are determined by the hydraulic calculations due to the valid technical specifications and standards considering the specific character of hydroautomatization, and in particular: the lengths of Drain II, on condition of their being run through and in case of the double-sided filling, shall be increased up to 200 m with the optimal slant of 0.002 to 0.003; the drainage collector 9 and the aeration collector 10 are with no slant, the diameter of the latter is one order higher than the diametre of the drains; the drainage and moistening collector 8 shall be put along the field slant in its middle, if the width is up to 300 m, and in case of a smaller one - it shall be done along the border of the field; each 200 m at the drainage and moistening collector 8 there are built the water receiving wells 12, 13 and 14, their optimal depth is 1.5 m, the diameter of the main water receiving well is 1,5 m, that of the rest ones is 1.0 m. Inside the wells there are arranged parting walls 15 with the water discharge slots covered with gates and others.

Taking into consideration the said specification, the developed design of the module for the pilot shop with a hydrolic automatization to regulate the water regime of the dried lands was implemented in the project for reconstruction of the drainage and moistening system "Ikva" in Rivno Region.

The ecological and economic effeciency of such a design of the drainage and moistening system is reached on account of the following:

- prevention of an excessive flushing of the mineral fertilizers and other technological chemicals by the drainage gate from the reclamated lands, as well as improvement of the ecological state of the natural water sources and water receivers of the drainage systems;
- saving the local water resources by means of fixing in the fields the surface and drainage gates;
- increase of the technical level of operation of the drainage and moistening systems and productivity of the reclamation farming agriculture.

PREDICTION OF THE ECOLOGICAL SITUATION OF THE SMALL RIVER BASINS IN CONDITIONS OF ECONOMIC MANAGEMENT

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The exisiting models for prediction of stafe of the water ecosystems reffer mainly to the shorferm prognosing concerning contamination of the water flows on the basis of separate indicators or of their combination. The task of the ecological prediction of state of the small rivers includes nowadays a complex assessment of the mutual interference of the anthropogenic loading constituents on the state of a small riwer ecosystem with the aim of saving the natural equilibruem in its basin, while the recewed results should be used for solving of the socio-ecological problems.

That is why the task of the ecological prognosing was formulated as one for a system socio-ecological prediction of the middle-and long-term changes in the basin, while for its solving there was used a prediction model based on a system model of the object. Such prediction is based on modelling of the quality of the natural environment of the river basin and allows to develop variants of the water protection actions; such ones as the rational use of the river run-off, improvement of state of the water and land resources. Wih that there is realized a basin and branch principle of the nature utilization. On the level of separated branches of economy prediction is performed according to separate indicators or criteria that are characteristic for certain kinds of the nature utilization. The basin principle is applied as a generalizing one wlich takes info consideration special features into consideration special features of conditions of the nature utilization and variants of the nature protection actions for separate branches.

In accordance with the basin-branch principle of the nature utilization there was put forward a concept of prediction of the ecological state in the river basins, the concept is based on the hiercharcical prognosing model which is performed on two levels. The prognosing approach is based on studying of the quantitative and qualitative aspects of the economic activities in the river basin. Revealing of the existing regularities in separate subsystems and their formalization, as well as, in case of presence of local dependences, is done by making a complex system model analysis and by predicting the state of the anthropogenic loading in the river basin.

On the first level of the hierarchy there is performed the long-term progmosing concerning separate indicators of the subsystems. With that the regulating and investigating methods of prognosing are used while estimating the final results in the system of the ecological criteria (as contrasted to the socio-ecological ones).

On the second level of the hierarchy the basin is considered like a system made up of separate subsystems prognosing concerning which is performed by means of the regulating and investigating methods with use of the socio-ecological criteria of estimation. For the socio-ecological prognosing there

was identified a logico-mathematic model for calculation of the anthropogenic loading on the basin of a small river, in that there are singled out the following subsystems: "The Radioactive Contamination", "Utilization of the Land Resources", "Utilization of the River Run-Off", "Water Quality", and which is nowadays used to classify the state of the anthropogenic loading in the basins of the small Ukrainian rivers and their ecological state.

When developing the industrial prognoses suggested model cat be used to estimate the state of the basin taking into consideration development of the productive forces in the gwen region.

On each level of the estimations for a subsystem (both concerning separate criteria, and their complexes) the quantitative prognosing - this is relating to the ecological criteria, and the qualitative prognosing - that is relating to the socio-ecological criteria, are made. On the basis of formalization and carrying out the prognosing expertise for each subsystem there is performed a system prediction of the state of the whole basin.

On the first level of the hierarchy, within the frames of the operating system model there was developed and tried, on example of the Irpin' river , a model for a long-term prognosing of the hydrochemical indicators that best of all characterize the anthropogenic loading, there were also identified the trends concerning their long-term changes. Even by the prognosis of the hydrochemical indicators allows to predict the socio-ecological state of the basin on the whole as well as the sfete of other subsystems, to compare the predicted values of the indicators with their standardized values to make effective decisions relating saving and optimization of the environment within the ecological acceptable limits.

INFLUENCE OF THE HYDROPLANTS'DAMS CONSTRUCTION ON THE ECOSYSTEMS OF THE FLOODPLAINS OF THE SOUTHERN BUG

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The flow of the river Southern Bug is regulated by 16 hydroplants with blind dams and overflow dams. Dams' construction, as it was found out, strongly influences the character and scale of changes of the floodplain ecosystems, the peculiarities of the river bed formation and abrasion of banks in the lower still waters of the hydroplants.

Blind dam causes to life the effect of prolongation of the drought period and promotes to the lowering of the volume of the river flow, especially in the drought period that makes the river bed drainage the floodplaim of the lower still water. The result of this phenomenon is aridization of the floodplains in the lower still waters of the blind dams on the Southern Bug (hydroplants Gaivoronskiy, Letichevskiy, Glubochinskiy, Ladizginskiy). The hard stepping of the floodplain vegetation is also observed, such steppe species as (Festuca, Stipa, Koeleria, Thymus, Artemisia austriaca, Artemisia absinthium, Verbascum, Eryngium, Ahillea and others) and weeds as (Echium, Plantago, Fagopyrum tataricum, Xanthium strumarium, Amaranthus, Malva, Atriplex alba, Atriplex tatarica and others) introduce into meadow communities. The microcountour tessellation of vegetation communities encreases and the quality and bioproductivity of the meadow communities lower. Such stepping of the floodplain meadows is especially strong in the region of villages Zabugie and Gurievka.

Construction of the overflow dams (hydroplants: Shirokaya greblia, Savranskiy and others) weaken the named negativ changes of the floodplain ecosystems in the lower still waters of the hydroplants, but promotes to the bank abrasion, causing undermining and collapsing of the river banks straight behind the dam and up to 500-700 meters lower, that occures in the periods of highfloods (seasonal or heavy shower).

ECOLOGICAL CONSEQUENCES OF WATER RESERVOIRS' MAKING IN KURSKYI DISTRICT

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The Central Tzhernozem area has the less water resources (115 hundred m^3 per 1 km^2) in whole Russia. Artificial reservoirs' making in this region was the answer for the growing up needs of agriculture, industry and population.

Kurskyi district is urbanized and well developed region now. Artificial reservoirs took the big part of the cultivated area. It is possible to select some ecological consequences which are happened as a result of widspreading storage reservoirs creation.

The most negative occurs in the regions, where the all area of watershed are ploughed and antyerosion activity isn't enough. In these cases the deposits moving by water erosion from slopes near reservoirs very high and reservoirs are siltificated very soon. The erosion matter also comes into reservoirs from watershed (reservoirs Borshevskoe, Uspenskoe and others little one). Siltification are the indicator of the erosion activity at the watershed. The small storage reservoirs made mainly in upper parts of small flat-bottom valley accumulate deposits, coming with water from neighbor area.

The reservoirs' and streams' siltification and growing up by aquatic plants are common in this region. the result of these is water level rising in the artificial lakes and as a consequence it leads to overmoistening and swamping of the river valleys. the water regime of soils changes and it provoked the soil and plant cover evolution in the lowest parts of reservoirs' shores. The overmoistened and swampy soils reached 150 thousand ha in Kurskyi district now. These area covered mainly by bushes and hillocks and so it is impossible to use it for hay-making. The harvest of these flood plains less then 7-10 tz./ha.

In the last 100 years antropogenic impact on are the flooding area are growing, In this connection the wild plant communities saved here only on small patches, mainly on the valleys' slopes (water predicting forests with oak, elem, hazel), in the flood plain (riverine mixteherb - sedge meadow), in deep balka (shrubby forests), partly in watershed area there are artificial pines forests.

The final results of this kind of antropogenic impact are the deep changes of the landscape structure in this district. Ecological consequences of the storage reservoir making appears slowly, but all are reciprocal. So the studying of such multysteps processes must be organized as a complex, basing on investigation, which was made during many decades.

COMPUTATIONS AND FORECASTS OF WATER AND HYDROCHEMICAL REGIME FOR THE WATER RESOURCES OF RIVER MANAGEMENT

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1. Basins of many rivers in industrial regions differ by unfavorable ecological conditions. The uniform control system of eater quality in river basin is needed which should take into account the conditions of runoff formation, processes of dilution, moving and transformation of water masses and pollutions along the river network. The efficiency of control system is defined not only by completeness and accuracy of initial observation data, but also by opportunities of data interpretations, that objectively is executed by using of mathematical models, enabling to calculate and predict the quality changes.

2. In long-term project, the anthropogenic effects may be evaluated, for example, on the basis of the water resources change forecasting in dependencies on climatic changes, processes on the surface and in the depth of a river basin and according to different versions of economic development on the river watershed area. The short-term water and hydrochemical regime forecasts on different reaches of river system are elaborated on the basis of computation of water masses and pollutions moving along the river.

3. On the chair of hydrology, in Tomsk State University the mathematical models, enabling to decide the task of monitoring and control of the Tom river water resources are elaborated. The Tom, the large tributary of the Ob, is one of he most polluted rivers in region. The river waters downstream of Kuzbass industrial centers are polluted with untreated sewage, shaft water removing and are dangerous for human health. The watershed area is 62,000 sq. km. Upper part of the basin has middle and low-mountain forest landscapes; it is here that the main part of the Tom water inflow is formed. In its middle course the river runs in the hollow and in the low course it spread on the West Siberian plain.

As a mountain river the Tom is distinguished by the very high specific rate of water flow and has the multi-peak flood, during which about 70% of the annual runoff passes. The earlier peaks are of snow origin, the later ones are of rain origin or mixed. The summer low-water period is unstable, it is interrupted by rain floods, the latter are also observed in autumn. The winter dormant period is steady, it is the limiting one for water-consumption.

4. The statistical models have been derived as multiple linear regression equations for the Tom runoff near Novokuznetsk and Tomsk for different months and seasons depending on the precipitation and air temperature measured at few representative meteorological stations at a month discretion interval. The models are valid from the genetic standpoint, steady and characterized by rather precise approximation. They permit to predict the runoff changes caused by moderate changes of climate (be they natural or anthropogenic). Possible changes of monthly and seasonal means of the Tom river runoff are calculated according to designed climatic changes version.

5. Mathematical model for computation and forecasting of water and dissolved pollutions daily discharges based on Duamel's integral and probabilitical treatment of channel runoff transformation is proposed. It permits to calculate water pollutants discharges in the upper cross-sections are known and the effect of nonpoint sources of pollution are taking into account. The calculates discharges or concentrations (dissolved oxygen, biochemical oxygen demand, ect.) are closed to the measured ones.

HYDRO-ECOLOGICAL PROBLEMS OF THE USE OF WATER RESOURCES IN RESERVOIRS AND SMALL RIVERS OF THE DON BASIN

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The approach to the water management in the river Don basin, the main source of the freshwater runoff into the Azov Sea, has given ise today to practically all possible kinds of human impact on water resources. The quantitative and qualitative changes in the river flow have disturbed the harmony of the ecosystem and produced a number of ecological problems the main of which relate, in terms of fishery, to losses in biological potential of the waterbodies.

Studies of the spatio-temporal structure of the water balance of the tributaries of the Severski Donets, as well as of the rivers Chir, Tsymla, Sal, Tuzlov and Mokry Elanchik have shown that the irretrievable water consumption in their basins accounts for the 25 - 60% of their annual runoff for the 50 % frequency of occurrence. In most of the basins under consideration water resources for the annual 75% frequency of occurrence have been practically exhausted and further use of the river flow for economic purposes is now possible only on condition of serious changes in the systems that regulate water consumption or if certain redistribution measures between the basins are realized. The situation becomes particularly difficult in the years with the 95 and 90 5 frequency of occurrence.

The fact that the planning of the water use often neglects the needs of the fisheries has led to a reduction in the spawning areas and in some years quite insufficient velocities of the river flow that would be suitable for fish coming to spawning grounds (0.4-1.0 m/sec).

Calculations of the content of salts in water in the chain of the Manych reservoirs indicate that in addition to the parameters of the river flow the mineralization of water has become a factor that impedes the fish productivity. The effect of the irrigation in the agriculture on the formation of the salt-ionic content of the Egorlyk river which feeds the Manych reservoir is given by the equation

$$\Sigma U = 1{,}13 * 1{,}008^{F}, (\eta = 0{,}73),$$

where ΣU is the maximal annual value of the mineralization of the river Egorlyk, g/l and F is the irrigation area, th. ha.

Any improvement in the hydro-ecological regime in the river Don basin can be expected only if the extensive water consumption is stopped and replaced with the methods of water management based on scientific research data.

The paper gives specific recommendations aimed at the introduction of ecologically admissible water consumption in the river Don tributaries and at the reconstruction of the Manych reservoirs and a portion of the river Sal, so that the conditions for fish and crayfish could be restored.

ANTHROPOGENOUS INFLUENCE OF LENINGRAD NPP ON KOPORSKAYA BAY COASTAL WATERS (GULF OF FINLAND)

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Data of long-time ecological monitoring of Koporskaya Bay (Gulf of Finland) coastal waters, that are used for cooling of the Leningrad NPP condensers, are presented in the paper.

Physical and chemical characteristics of the water quality and also structure of plankton communities were monitored from 1978 up to recent time. Due to our data there were accomplished: quantitative assessment of pollutants content; analysis of long-time succession of phytoplankton community (one of the most sensitive biological indicators).

Rapid dynamics of the process of eutrophication in coastal waters reveals anthropogenous character of eutrophication. From early 1990s coastal waters may be regarded as mesotrophic - eutrophic natural waters according chlorophyll "a" concentrations.

Our investigations showed, that nonradioactive factors of NPP's influence on environment become most significant when normal regime of the NPP operating is ensured

SECTION I
WATER RESOURCES

SUBSECTION
GROUND WATER

ECWATECH

POTENTIAL OF GEOPHYSICAL CONTROL OVER OIL WASTES OF GROUND WATERS

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Frequent damage of oil and pipelines of recent years, as well as inaccurate attitude towards overflow of oil during extraction made geophysical controll over hydrocarbon wastes of ground waters one of the most important tasks of ecologycal geophysics.

Possibility of successful usage of geophysical methods in localization of oil wastes in ground waters is based on the difference between oil and water physical properties.

First, different are values of the elastic waves velocities : for water - 1500 m/s, for oil - not higer than 1100 m/s. Oil viscosity in several times higer that of water. Spliting effect decreasing elastic waves velocity is absent in oil and its products. Nonlinear constants of oil are higer than that of water.

Oil and water differ considerably as to the values of electrical resistivity and dielectrical constant.

The dencity of oil and its products is close to 0.8 g/cm^3 which is much lower that water density.

All the above factors prove effectiveness of usage of geophysical methods in localization oil wastes.

But it should be noted that these possibilities have been used comparatively rarely.

CHANGE OF A CHEMICAL STRUCTURE OF DRINKING GROUNDWATER MIDDLEAMUR ARTESIAN BASIN ON SITES WATER-SUPPLY IN PERIOD OF INPUT THEM IN OPERATION

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The main transformation of a chemical structure of drinking groundwater Middleamur artesian depression on sites water-supply occur as a result of change of the contents in a water of Fe and Mn. In the majority cases of change chemical structure of groundwater are studied in water-supply which have long term with relatively stable flow.

During commissioning water-supply on Mostovoi site of Hurbinskiy deposit for the first time wore received and analyze data on content of a iron and manganese, describing process of transformation of groundwater at the moment of transition from natural to condition infringed by operation of the aquifer.

Mostovoi site of Hurbinskiy deposit of groundwater places on the left bank flood-lands of the river Amur. Water-supply of Mostovoi site consists from 15 operational wells located on a number parallel of the river-bed on distance 30 m from each other. Groundwater of aquifer (N + Q), submitted by sand which inclusion gravel and pebbles are maintained. Capacity of a complex saturated from 33.8 up to 66.0 m.

The groundwater on the majority of parameters satisfied to the requirements GOST 2874-82 "A drinking water", the exception was made with increased contents of a iron (5 - 12 mg/l) and manganese (0,42-1,18 mg/l).

From the moment of start-up in constant operation on Mostovoi water-supply there are 5-7- wells with total productivity 18-20 thousand m^3/day. For a time of operation since 1991 till 1995 the dynamic table in a center of row was established at a depth of 17.0 m.

The contents of an iron in wells of Mostovoi water-supply has increased in current of 1-3 month from the beginning of operation from 5-10 mg/l up to 20-3- mg/l (on separate wells - up to 50 mg/l). During 3 years the slow gradual growth content of an iron was observed and its content was stabilized to a middle of 1994 on significances close 30 mg/l.

The content manganese in wells of water-supply similarly to an iron has changed very quickly during several months from 0,2 - 0,4 mg/l up to 1,0-2,0/l. After significant fluctuations the concentration of this element was stabilized to a middle of 1993 at a level 1,1-1,3 mg/l.

The sharp deviation of the contents of an iron and manganese has essentially affected on a work of clearing structures.

The productivity plant of clearing from iron is lowered from 50 000 m^3/day (under the project) up to 25 000 - 30 000 m^3/day.

The significant increase of the contents of a iron and manganese can be stipulated of flowing of groundwater with increased content of an iron and manganese from a top of an aquifer, an infringement of natural hydrodynamics of conditions in it. The groundwater, arriving to the operational wells from various parts of an aquifer undergo in zone of screen essential transformations. On these transformations render maximum influence the local factors in zone of the well. A degree and direction of these transformations depend from the hydrogeochemical conditions in this zone, which is formed largely under influence litology structure of the saturated rocks.

Content of an iron (and manganese) in the wells located in a distance 30 m from each other in the separate. Cases differs in several times (well No. 8 - 10-15 mg/l, and well No. 9 - 45-55 mg/l).This implies, that the zone of maximum transformations of a chemical structure of groundwater hear the wells is limited to radius 10 - 15 m. The maximum reduction ability in the relation to an iron and manganese in zones of the wells can be connected with sites, where the sulphatereduction with the allocation H_2S and thickness with the increased contents of organic substances take place.

CHANGES OF SOME CHEMICAL AND MICROBIOLOGICAL CHARACTERISTICS OF SOIL AND PHREATIC WATER AFTER IRRIGATION WITH STOCK-FARM WASTEWATERS

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The application of irrigation in Vojvodina has been accompanied by the development of stock-farms. Cattle raising on big farms, the mode of the objects maintenance and discharge assume temporary disposal of the wastewater in lagoons near the farm. This wastewater contains a number of dissolved constituents that can be useful for plant production, so that its use for irrigation would be highly desirable. However, in view of the presence of some dissolved substances, as well as the concentrations of some nutrients, one must be very cautious in using stock-farm wastewaters. A rational application of these wastewaters in crop production may contribute to a decrease in the consumption of mineral fertilizers, but can also cause some undesirable changes in the soil properties and quality of the obtained products. The use of these wastewaters enables closing of the cycles of some substances, which can have positive effects in the environmental protection.

Regardless of the fact that the criteria (primarily those concerning health aspects) on the use of wastewaters, have already been defined, in the year 1990 at the lysimetric station of Rimski Sancevi an experiment was started with the objective to investigate the possibility of using stock-farm wastewaters for irrigation of field crops. In view of the environmental protection, the same experiment is also concerned with the effect of wastewater on some chemical and microbiological characteristics of the soil and phreatic water. Maize and sunflower have been chosen as experimental crops. The crops in the lysimeters were supplied either with usual doses of mineral fertilizers, or wastewaters, the quantity of the latter being determined using the N_{min} method. The water table in lysimeters was maintained at the depth of 120 cm. The elements of water balance during the growing season were measured each fifth day. Sampling of phreatic water was carried out in accordance with the chaacteristics phases of crop growth and development and when an excess of water was present in the lysimeters, so that the conditions were fulfilled for nitrogen balancing under the given conditions. All water samples were analyzed both chemically and microbiologically. Soil samples for microbiological and agrochemical analyses (by standard methods) were taken in the different stages of crop growth. Total contents of microelements and some heavy metals were determined by boiling with HNO_3 , whereas available nutrients were determined by AAS method after their extraction with 0.005M DTPA+0.05M $CaCl_2$ +0.1M TEA.

Treatment of the results of chemical analyses of phreatic water indicates the real possibility of using stock-farm wastewaters for irrigation of field crops. According to the results obtained up to now it can be stated that undesirable effects of the applied wastewater on the quality of phreatic water are not presented more than in the case of applying other mineral fertilizers.

To follow the changes in the contents of biogenic elements and heavy metals, the soil in lysimeters was analysed before applying farm wastewater and after its application (at the end of crop vegetation). The lysimeter soil was a carbonate chernozem, neutral to weakly alkaline, with average humus and total nitrogen alimentations. Contents of available phosphorus and potassium were in the class of optimal alimentation of the soil surface layer, decreasing with the depth. Crop nutrition with wastewaters yielded an increase in total and available contents of the investigated microelements in soil at the end of vegetation season, compared to the non- fertilized lysimeters. No contamination of the soil with Cd was observed in the fertilized lysimeters, as extremely low contents (both total and available) of this element were measured. Total lead content remained unchanged, whereas a decrease of its available form was observed in all lysimeters at the end of the vegetation season, indicating that this element was taken up by the growing crops. A comparison of the contents (total and available) of heavy metals in the soil before and after fertilization with wastewater and their allowed contents in agricultural soils shows that the contents of these elements in the investigated soil are far below their contamination levels, so that such soil can be used for good production.

By introducing stock-farm wastewaters, high populations of living and dead micro-organisms reach the soil. In this way total biomass is increased

and microbiological processes are thus intensified. If the soil is poorly structured and has a lower content of organic matter, part of micro-organisms can reach the phreatic water and affect its quality. In the present experiments we monitored the counts of ammonia forming bacteria, ureolytic bacteria, nitrifying and denitrifying bacteria in the wastewater, soil, and phreatic water, before and after adding stock-farm wastewater. The counts of amonifying and ureolytic bacteria in wastewater were about 10^8 ml^{-1}, denitrifying - 10^5 ml^{-1}, and nitrifying bacteria -10^3 ml^{-1}. Addition of wastewater caused a small increase in aminoheterotrophs and a significant increase in the count of nitrifying bacteria in the soil. Counts of amonifying bacteria in phreatic water before and after application of wastewater remained unchanged (about 10^2 ml^{-1}), whereas nitrifying and ureolytic bacteria were not detected. At the same time, denitrifying bacteria were detected only in certain combinations of experimental conditions.

THE CONDITION AND PERSPECTIVES OF SUBMERSIBLE ELECTRIC PUMPS MANUFACTURE'S DEVELOPMENT IN RUSSIA TAKING INTO ACCOUNT EXPLOITATE RESERVE AND THE LEVEL OF UNDERGROUND WATER USING

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The problem of underground water wider using in Russia is actual problem in consequence of superficial water springs' pollution being continued.

In present time more 70 percent of Russia popular use water of open springs, reservoirs, wells, rivers and lakes for drinking and everyday needs.

The using of industrial developed countries' experience is the simplest and the most expedient way in such situation as 70-95 percent water everyday needs of these countries is covered by water from deep artesian wells.

There are sufficient reserves of highly qualitative underground water everywhere in Russia. We were calculating and forecasting needs in pump equipment, its productivity, heads, depending on well's diameter. At the same time we were taking into account that structures of well funds are quite different in present time, but economic factors will exert decisive significance on types of pumps manufacturing in Russia and result in essential change of its well fund.

In Western countries 4" wells amount to 77 percent of well fund, 6" - 16 %, 8" - 4 %, 10 - 2 %; 12 - 1 %, and in Russia there are 2.3 %; 53.0 %; 24.0 %, 9.0 %; 6.4 % accordingly.

We suppose change of types of submersible electric pumps manufacturing in Russia and well fund and consider need in electric pumps for 4" wells and in higher expensive electrical pumps for each of well's sizes must be increased. The manufacture of electrical pumps for similar figures giving-pressure for wells of larger diameter will decrease in this case as a consequence.

Indexes of need in different types of electric pumps in 1996-2000 are calculated in State Federal Program for creation and production of pump equipment for water pipe and canalizate economy of Russia and will be shown in the report.

The analysis of present situation in submersible pumps engineering in Russia and forecast for future events dictate stipulate the need in effective support on administrative and state level of enterprises manufacturing pumps.

In present time submersible electrical pumps are manufactured, as a rule, under design documentation of the joint-stock company "Hydrotechnika" and Special Design Bureau of unpoled pumps. Perspective designs of submersible electrical pumps for wells 4, 5, 6, 8, 10 and 12" with mass lowed by 15-20 % in comparison with ones manufactured serial, increased unrefused work by 30-40 % and the efficiency by 2-5 % at the expense of progressive technical decisions are worked out by designers of these organizations and suggested for introduction. The level of these pumps corresponds to and in a number of cases it excels the technical level of numerous foreign ones.

Realization of Program production of submersible electric pumps will enable to satisfy maximum need of Russian regions in water at the expense of using underground water since 2000 year.

GROUNDWATER USAGE FOR MOSCOW REGION WATER SUPPLY

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1. At present the groundwater usage for domestic and drinking water supply should be performed at a qualitatively new scale characterized by the necessity to use groundwater for large concentrated water users.

This necessity is brought about firstly by the need to improve the sanitary and ecological protection of the sources resulting in considerable improvement of the total safety of the water supply systems as well as the improvement of the quality of the water the population is supplied with.

The above-mentioned tendency is most fully reflected in the establishing of additional united system of Moscow agglomeration water supply with the groundwater usage.

2. At present the water supply of the City of Moscow is carried out through the usage of the surface water of the Moskva River and the Volga River multifunctional water engineering systems. Sufficient safety of Moscow water supply system was for a long time secured owing to large water catchment areas of the above-mentioned systems (abut 60 000 km^2) and the possibility of year-by-year runoff control having the total effective storage capacity of about 2800 million m^3.

Nevertheless during the last decade under the conditions of increasing ecological technogenous and emergency loads on the zones of surface water supply sources formation of the City of Moscow and the depletion of the resources the necessity to improve the safety of the water supply system has become quite obvious. This safety improvement must be achieved firstly through the establishment of additional independent and safe (from the sanitary and ecological point of view) groundwater sources capable of providing the centralized water supply of the basic objects of the City in various non-typical situations.

3. The water supply of the towns located in the Moscow Region is based on depleted local groundwater sources. Apart from that the groundwater is polluted as a result of groundwater abstraction above permitted limits, insufficient protection of these resources and non-observance of sanitary and ecological requirements. The replenishment of groundwater resources is possible in case of groundwater abstraction reduction by 0.46 million m^3/day. But in this case it would be necessary to obtain some additional water sources.

Thus at present concerning the Region as a whole it is necessary to establish the united water supply system for the City of Moscow and the towns of the Moscow Region using the groundwater. This system should provide the complex solution of the problems concerning the improvement of the water supply safety as well as the improvement of the quality of the water the population is supplied with.

4. With this aim in view certain geological prospecting work was carried out resulted in the discovery of groundwater resources located in the North, South, West and East of the Moscow Region. These groundwater resources are capable of providing water supply amounting to 2.7 million m^3/day (1.4 million m^3/day for the water supply of the City of Moscow and 1.3 million m^3/day for the consumers of the Moscow Region).

Based on the groundwater resources prospected there have been designed a united system for the City of Moscow and the towns of the Moscow Region water supply including four interregional water supply subsystems of the following output:

the South - 1.2 million m^3/day;
the North - 0.8 million m^3/day;
the East - 0.56 million m^3/day;
the West - 0.14 million m^3/day.

5. It is evident that the abstraction of such a considerable amount of groundwater envisages a through analysis of the corresponding environmental impact. With this aim in view the study of natural territorial complexes located at the zones of vast groundwater depressions was carried out as analogues. The results obtained permit us to make a conclusion about the absence of any absolute contra-indications concerning the groundwater abstraction under the following conditions: step-by-step increase of this abstraction; complex ecological monitoring compensatory measures practicing and the possibility to decrease the groundwater abstraction in the most unfavorable periods.

6. Additional groundwater usage may considerable improve the supply of the population with high quality water and to improve the safety of this water supply.

The work concerning the establishment of the united water supply system for the City of Moscow and the towns of the Moscow Region using groundwater is the priority trend in the development of ecological safety systems for the population and municipal economy of the Moscow Region.

TO THE ESTIMATION OF GEOFILTRATIONAL PARAMETERS ON THE RESULTS OF THE FREE OSCILATION OBSERVING OF HEAD LEVEL IN WELLS

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In the number of our publications of last years the theory of relaxation filtration have been developed in that part, which provides the satisfactory approximation to the autographic head oscillation process in liquid p or head level H ground water after the impulse excitement of aquifer. In the base of theory there are wellknown propositions of theoretical gydromechanics. Firstly, monochromatic stationary waves to determine free oscillations of level in wells are formed in closed limited volume of conductive (porous) medium. Isolated aquifer cross-section in accordance with condition is separated by impermeable hard horizontal surfaces - bottom and roof. The closity of volume in a plan depends on the structural liquid in porous medium realizing by the presence of the movingly solidity in it. The vertical surfaces on which the edge parts are implemented the condition |grad p| - G (where G is the module initial gradient of liquid head) and are limited of perturbation sphere on the plan. On external part of bed the liquid conducts itself as a hard body.

Secondly, the notions about of relaxation phenomena in liquids are put down in the base of the filtration wave equation. Maxwell, on the base of those notions suggested a theory about

absence of principal differences in mechanical properties of liquids and hard bodies. Liquids are becoming deformed resiliently under the short-term influence. After stopping of deformation the stresses of displacement appear inside them, which are damping for a period of time. Under long-term influence they conduct themselves as glution liquids.

The equation of liquid moving taking into consideration the filtration velocity relaxation in total with equations of indissolubility and condition results to equation of heat conductivity. It is the most common non linear filtration equation, with using of which any process of moving liquid through permeable medium can be analyzed.

The solution of the problem of autographic head oscillation in perturbic well after the impulse perturbation aquifer under assumption weak damping is showed as:

$$p(r,t) - p^{\circ} \times \exp(-\beta t) \times \cos(\omega t \pm \varphi) \times J_{o}(æ r),$$
$$æ^{2} - (t_{o}(\omega^{2} - \beta^{2}) + \beta)/\chi, \ \beta - 1/(2t_{o}), \quad (1)$$

where p° - maximum head overfall given in the test; β - coefficient of oscillation damping; ω - frequency of oscillations; φ - phase angle; J_{o} (æ r) - Bessel function of displacement stresses damping; χ - deposit piezoconductivity; t - time. The equations in (1) are the oscillation system with infinitely number of autographic frequencies, which are determined as

$$\omega_{s} - \sqrt{[(j^{2}1.s \times c^{2}/R^{2}) - \beta^{2}]} - \sqrt{[\omega^{2}o_{s} - \beta^{2}]}, \ c - \sqrt{[\chi/t_{o}]}.$$

Where c - velocity of wave distribution; $\omega^{2}o_{s}$ - autographic frequencies under the absence friction forces (resonans frequencies); R - radius of perturbation sphere; j1.s - zeros Bassel functions first kind, first range J_{1} (æ R); s - 1, 2,... .

The method of interpretation of the results of observing head oscillations in a well, is suggested to guarantee the estimation of the geofiltrational parameters. The ways of its definition have been planned.

THE METHOD OF RELIABLENESS ESTIMATIONS OF THE GROUND WATER FILTRATION STUDYING

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The studying of the ground water filtration processes in aquifers, soils and deposits in aeration zone, their prognoses suppose the presence of definite set of the filtrational and migrational parameters of conductive environment. The last are determined as a result of special filtration and migration testing on aquifers, soils and deposits of aeration zone. In full accordance with error theory under the measurements and calculations in process of carrying out and interpretation of the result of such tests the probability of distortion the determined filtration and migration parameters is arised, that is, involving in the systematic and accidental errors. That's why, the estimation of the parameters environment precision (in total with probable errors of meaning, interpolation and extrapolation under the basing of the calculated value parameters) determines the trustworthiness of hydrogeological and engineering-geological calculation and prognoses.

The revealing and exception of the systematic errors is inalienable part of engineering calculations. The main way of the exception of such errors is the carrying in the corrections with signing the results of measurements and calculation. The overwhelming part of publications on geohydrodynamics is devoted to estimation of systematic errors and methods of its calculation. In all these publications all their kinds are developed enough in detail, thus in principal, it is the possibility of definition the filtrational and migrational parameters, the not registrated systematic errors of those would not be more than first per cents.

Another situation is turned out with the estimation of accidental errors of filtrational and migrational parameters. The latters are conditioned by displaying of lots factors, it is known that the character of displaying each of those factors is not reproduced exactly under the repeated (and next) testing of aquifers, soils and deposits of aeration zone. These errors in distinction from systematic, can not be excepted from results of measurements and calculations, so their revealing and estimation are very important, because after all just by them (under the possibility of exeption systematic ones) the trustworthiness and reliability of filtrational and migrational parameters.

The method of determination the accidental errors of filtrational parameters of aquifers has been worked out as the component part of method data processing under filtrational testing aquifers. It is guided by using as standard method of results interpretation the graphoanalitic and standard-surves ones. Accordingly, summary total exception errors of parameters are determined by trustable intervals which have been established on the base of regressive analysis of the test functional dependencies which connect primary measurements with parameters. The involving of errors data of measuring apparaturs provides the differentiation of total accidentalerrors into components.

The methodical working out are realised by the package of applied software for personal computer and are tested on data filtrational testing of aquifer in Central Kazakhstan. Such work and collection on its base errors estimation experience will be the base working out of the requirements to parameter trustworthiness for all hydrogeological and engineering-geological investigations. Still now such requirements have not been yet considered.

PROTECTION OF GROUND WATERS AGAINST CONTAMINATION WITH INDUSTRIAL WASTE EFFLUENTS WHEN SHIELDING STORAGES WITH MULTILAYER SCREENS

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The number of high toxic waste storages is steadily growing within the territory of Russia. During the storage of liquid wastes leaks of filtrate to groundwater eliminate them as a source of water supply.

When designing storages for industrial wastes great attention is paid to the development of insulating (sealing) impervious screens protecting natural waters against pollution. Multilayer combined screens, including those composed of two antifiltration elements with a draining interlayer are widely used.

In the world practice prefabricated impervious and protective mats, made in various combinations of clay soils, films, geotextile and other materials are often employed in the construction of storages. However, calculations or scientifically substantiated parameters of separate layers and elements of screens are not given in the publications.

At present analytical relationships are available for determination of variables of a flow passing through multilayer screens. They have been worked out by V.P. Hedriga, V.N. Zhilenkov, Yu.M. Kosichenko (Russia), Kh. Abadzhiev (Bulgaria) and others. In these works formulae of generalized permeability coefficient of a screen Kф include permeability and configuration variables of impervious material and protective layers, as well as the damage of a film and type of it.

When designing a screen of rational structure, it is necessary to know the effect of each factor on the impermeability efficiency of a screen and to select optimal combinations of elements' characteristics.

We have performed calculations using modified relationships of Yu.M. Kosichenko. The design of a multilayer screen composed of a protective clay layer - film - clay underlayer has been considered. Such

structure is used as an impervious element in a double or three layer screen with draining interlayers carrying filtrate out. Calculation are performed for the following varying variables:

- permeability coefficients of protective layer and underlayer K_1 and K_2, thickness of layer, film damage and type of it.

Head value was constant. Homographs for varying Kф and infiltration discharge have been constructed on the basis of data depending upon the given variables. These data permit to determine more profoundly leakages from storages for highly toxic wastewater.

Knowing concentrations of toxic components in a filtrate and their permissible concentrations in groundwater admissible leaks from storages may be defined more reliably without decreasing groundwater quality.

MODELLING MULTIFUNCTIONAL AUTOMATED SYSTEM USE FOR THE ASSESSMENT OF THE GROUND WATER INTAKE IMPACT ON THE HYDROGEOECOLOGICAL CONDITIONS OF THE ADJACENT TERRITORY

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The Multifunctional Automated System for modelling of ground waters and the assessment of their intake impact on environment is intended for the assessment of natural resources and operational supply of ground waters, the assessment of antropogenic impact on ground water resources and ground water intake impact on natural ecosystems and engineering objects, planning of water resource rational use and elaboration of water conservation measures.

The System is based on many years of experience of the CRICDWR ground water use and conservation laboratory and showed good reliability and efficiency.

Recently the researches on the assessment of water intake impact on environment were carried out in Minsk.

The conducted calculations made it possible to evaluate the main sources of operational supply forming from the quantitative point of view, to characterize the ground water level reduction dynamics in the adjacent areas, to define the shape and dimensions of dependence of natural ecosystems and engineering object conditions from the operational water intake regime.

The prognostication modelling enabled to define the zones of the negative water intake impact on streams and reservoirs, forests, arable lands and soil.

the system of nature conserving measures was proposed in order to prevent the negative changes of natural components in the negative changes of natural components in the negative water intake impact zone. It included more precise definition of the prospective building plan in Minsk, of the operational regime of engineering objects and some other preventive and organizational/technical solutions on the rational use of natural resources.

THE ASSESSMENT OF PROTECTIVE PROPERTIES OF THE UNSATURATED ZONE IN THE CONDITIONS OF OVERMOISTENING, CONTAMINATION AND DEPLETION OF GROUND WATER (METHODS, TECHNOLOGIES, RESULTS)

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In the environmental hydrogeology (ecohydrogeology) the unsaturated zone protects both the ground water against depletion and contamination, and also the very upper layers of lithosphere against salinization, contamination, water-table rise to the earth's surface (overmoistening) and overdewatering. On the bases of the multi-year theoretical and experimental works carried out at VSEGINGEO, the models of water exchange through the unsaturated zone were developed for different hierarchical levels (from capillary-film to regional). There are developed and proposed the methods, some technical means (in particular, dielectric moisture rate-meter) and technologies as a whole providing the possibility to perform geologo-surveying and monitoring environmental investigations and give scientific-informational support in replenishment of water-ecogeological reserves and resources (in particular, in the areas of artificial recharge of ground water).

The moisture transfer is analyzed from the theoretical and practical aspects, taking into account the equilibrium and migration of film- and capillary moisture, which enables, in combination, to study both very slow (in historical scale of time) and rapid (in physical scale of time) processes of migrating water and contaminants. It is suggested to introduce the concept of ecogeological resistance (return velocity of contaminant movement, rise of shallow ground-water level, etc.) as a measure to characterize the protective properties of the unsaturated zone.

The technology of assessment of protective properties of the unsaturated zone includes the

estimation of lithological structure and thickness of the unsaturated zone, rock moisture content, capillary-film potential, coefficient of moisture transmissibility, al well as direct observations using a remote dielectric moisture rate-meter, intensity of infiltration recharge and moisture transport velocities (average and maximum ones taking into consideration the structure of pore space). These technologies can be used both for local/regional works and for detailed and monitoring investigations. On some cases the available data bank can be used without carrying out field and laboratory works.

The values of infiltration recharge and contaminant transport velocity are estimated and the maps of appropriate scales are compiled for some regions of Russia.

Below are some estimates obtained for protective properties of the unsaturated zone while contamination in different regions:

Table.

Region and hydroecogeological conditions	Infiltration recharge mm/year	Moisture velocity in the unsaturated zone, mm/year	Time during which contaminants pass one meter of the unsaturated zone, days
1. The Kara-Kum, barkhan sands	6,8	343	1064
2. Daghestan, fine sands	20,0	500	730
3. Kaluga region, sands, arable lands	185	4700	77,5
4. Daghestan, clayey plateau	10	135	1639
5. Voronezh region, clayey plain	50	431	841
6. Kaluga region, loamy soils	100	843	388
7. Kaluga region, sandy loam, arable lands	253	2369	154

OPEN-PIT MINING OF DEPOSITS IN THE AREAS OF DUMPS. HYDROGEOLOGICAL AND GEOECOLOGICAL PROBLEMS

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Deposits of cement raw materials (argillites) are situated in immediate proximity to the Sukhoy Log - town (the Urals). At 100 to150 m distance from the deposit contour, there is a laid-up city dump of solid economical wastes (situated in a former small quarry) and, confined to the low , illegal dump of liquid economical wastes (waste water discharges of galvanic shops, faecal wastes, chrome-containing wastes of tanning industry, oi products).

Mining of cement raw materials in the area of the city, has been started in the 20-s of the present century. Up to now, raw materials (cement clays) are mined at small (5-6 m) quarries. Total areas of former and operating quarries are enormous. A full recultivation of them is practically impossible. It is impossible to choose areas for mining cement clays at small quarries due to both economic and political reasons.

Alongside with this, a considerable part of population capable of working is employed at the two cement plants. One of them is the main supplier of oil well cementation for Western-Siberian oil and gas extracting companies.

The way out of the present situation is to mine a compact enough deposit of argillites at a quarry with the depth of 40 to 60 m. There are no purely technical problems to mine such a deposit. The situation is aggravated by the proximity of dumps.

Under such conditions, when considering the possibility of mining the deposit, the most important thing will be to make a forecast of underground drainage water quality, to choose an economically and ecologically rational scheme of mining and drainage of the quarry, to ground measures on purification of drainage waters and the system of monitoring in the area of hydrodynamic influence of the quarry and dumps .

As a result of the analysis of prospecting results, hydrogeological inspection and mathematical modeling, there was developed a programme of hydrological monitoring in the area of the quarry, the area of resulting pollution has been defined in the first approximation, there was made a preliminary forecast of drainage water quality (for the worst version, as to the conservative ion of chlorine).

Geophysical works (geometrization of the pollution area by method of electrical profiling) have confirmed the results of modelling and allowed to define zones of higher conductivity in which pollution is especially intensive. As a result of prospecting modelling and geophysical works there was developed a network of wells for hydrololgical monitoring. A complex of hydrological, hydrogeochemical and microbiological works which was carried out provided for a reliable geometrization of the pollution area, helped to define components of pollutant (and components of pollutant markers), and forms of their migration.

The main problem of drainage water purification will be presented by compounds of nitrogen because compounds of heavy metals are absorbed by rocks at distances not exceeding tens of metres. By methods of trade-off mathematical modelling (trade-off forecasts of drainage water quality and amount of water inflow), an economically and ecologically rational scheme of stripping and drainage of an argillites deposit has been grounded.

SPECIALITIES OF INFORMATION TECHNOLOGIES APPLICATIONS FOR GROUNDWATER PROTECTION DECISION SUPPORT

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Organization of activities which provide prevention of negative impact on groundwater and minimization and elimination of the impact consequences is discussed. Actual success may be achieved only with the proviso that the development is tailored to needs of decision maker. In Russia hydrogeologists begin to realize the importance of this approach only at present. Monitoring expenses cannot be validated if the data of observations are not used for management purposes.

The main means of resolving the problems that was pointed out above is the computer systems created to support the making decision. On the other hand, development of a complex computer system may be unacceptable because insufficient funding can make development terms so long that computer system will grow obsolete before it can be used.

Report comprises example of simple applying software in groundwater monitoring data analysis for a drinking watershed located in one of the industrial regions in Russia. Software includes database control system, table processor, and a set of statistical programs, united by specially developed interfaces. Monitoring data statistical processing includes factor analysis and trend-analysis application. Multidimensional data factor analysis which is still not widely used in monitoring data processing occupies a particular place in the software. Trend-analysis data throughout the whole monitoring range have been used to forecast time interval for chloride-ion (the main contaminant) concentration to reach MCL value (350 mg/L for drinking water).

The experienced hydrogeologists are needed to be involved into the difficult situations to quick analyze the groundwater condition and make some recommendations for decision maker. To support this work the computer expert system (ES) is necessary.

Authors have started the ES creation to evaluate the groundwater condition and to support the engineering design. This system will be targeted to the expert-user who works in very difficult situation. Demonstration version has been created for the evaluation of the instep groundwater levels and groundwater pollution.

The GIS is planned to be used for the visualization of the spatial changes of the groundwater basic chemical components level, allocation of the pollution sources and protection constructions on all expertise phases. All created maps will be oriented to the expert-user. It is planned in the future to set up the computer support system to create maps for decision maker which are illustrated the main forecast characteristics made with the help of expert systems or types of possible solutions and their ecological and any other sequels.

ROLE OF THE ROCKS IN GROUNDWATER WATERFIELD CONTAMINATION IN THE AREA OF PHOSPHOGYPSUM PILE INFLUENCE: APPROACH TO THE PROBLEM

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The site under investigation is situated in the Moscow river valley on the territory of a large industrial enterprise. A drinking watershed is located in the area influenced by the enterprise. In this yonnection groundwater contamination may cause crisis situation in water supply. Piles of the enterprise solid wastes, i.e. phosphogypsum represent the main sources of groundwater contamination. Leaching of piles by atmospheric water causes groundwater contamination by sulphate-ions, calcium, fluorine, phosphorous, strontium, arsenic, and heavy metals. Interaction of infiltrating water with rocks results in significant alteration of groundwater composition due to the processes of precipitation, sorption and heterogeneous exchange. Necessity to protect drinking watershed from contamination required assess the role of rocks in controlling migration of contaminants from phosphogypsum piles to groundwater. Laboratory testing of rock samples from the pile area comprised investigation of:

1) character and degree of changes in rock salinization, gypsum and iron content, caused by technogeneous influence;

2) composition of microelements released by the pile and peculiarities of their accumulation in the vertical cross-section;

3) forms of heavy metal occurrence in rocks (both in plain and vertical cross-section).

The major part of migrating microelements (especially heavy metals) accumulates in rocks, thereby reducing content of contaminants in groundwater and forming the source of secondary contamination. During upcoming 25 years a number of elements will be accumulating in rocks thus decreasing significantly hazard of groundwater contamination. Subsequently, after saturation of rocks by contaminants, one should expect abrupt drinking water contamination.

PETROCHEMICAL POLLUTION OF GROUND WATER - ITS PECULIARITIES, REHABILITATION, AND UTILIZATION

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Liquid hydrocarbons (oil and petroleum products) are among the main, the most widespread, and hazardous pollutants for environment and health of the people. They are characterized by high biological activity, many of them are carcirogenic matters. Therefore, the effect of petroleum products on the environment is an ecological problem of prime significance.

Soils and ground water are the main land environments under contamination.

Oil refining plants, oil fields, civil and military airdromes, bulk plants, refuelling stations, military and civil fuel warehouses, and oil pipelines are the sources of petrochemical pollution of ground water. Such local objects as bulk plants, fuel warehouses, and refuelling stations become of special significance due to their large number.

Soil and ground water contamination at these objects take place as a result of systematic and occasional escapes from technologic systems during filling in and discharge of reservoirs. Emergency leakages are of great danger.

Leakages are distributed irregularily within an object area varying in space and in time. Therefore, soils and ground water may be both highly polluted and of lower contamination in different areas. On the whole, a contamination pattern is of local and nonuniform character, especially concerning soils.

When coming at a land surface, petroleum products first of all contaminate grounds (including soils), aeration zones, and ground water. The pollution of ground water is indissolubly connected with that of soils of an aeration zone.

The occurrence of hydrocarbons in ground water is distinguished by the formation of a lens of petroleum products, a zone of soluble hydrocarbons, and a gaseous envelope.

A spot of neat oil product (oil lens) is formed at a ground-water table. An oil product lens is confined to a top aquifer and as if floats at a ground-water surface due to its lower density as compared with

water. A zone of dissolved and emulsified in water hydrocarbons is formed around the lens and under it, an area of this zone exceeding that of a lens. Due to evaporation and diffusion, a gaseous hydrocarbon shell composed of light hydrocarbon mixture with predominant methane is formed above the lens of oil products.

The paper considers ecological consequences of ground water pollution, states the approach to an assessment of a ground water protection from petrochemical pollution with allowance for a phase permeability of rocks in the case of joint motion of oil and water through them.

The paper considers the criteria of ground water and soil petrochemical pollution. Contamination levels proposed by us to characterize a petrochemical pollution of ground water an to substantiate the measures for its rehabilitation are taken as criteria of ground water petrochemical pollution.

The paper considers the concept of safe levels of ground water and soil purification, which are the concentrations of oil products in water and soil achieved with the use of special methods, is the characteristic feature of presented categories of ground water and soil pollution. Below safe levels, the purification is carried out due to natural processes. This allow as to make a rehabilitation of soils and ground water polluted by oil products more rational and effective.

The paper considers the technological scheme of rehabilitation measures is presented.

CONCERNING THE PROBLEM OF REEDUCATION OF POPULATION IRRADIATION CAUSED BY THE NATURAL RADIOACTIVITY OF UNDERGROUND WATER USED FOR WATER SUPPLY

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Due to increasing level of population or lack of surface water, underground water sources are becoming more and more important for water supply. Somewhere, as it is for instance within the Moscow area, role of the underground water is becoming dominant. However, as it was recognized during last decades, intensive development of an underground water deposits meets the problem of radioactive safety dealing with the potential increasing of natural radionuclids concentration, radon and radium in particular. Some cases were known when the concentration of radionuclids in the underground water was several orders more then the background level.

At 1985 in the USA, when the same problem was recognized, they accepted special program to reduce the irradiation of inhabitants caused by radon. Similar program was accepted by the European Council in 1989 for all the countries of the European community (EC). Government of the Russian Federation has also approved the Federal target program of reduction of the irradiation level for the population and personnel caused by the natural radioactive sources ("radon program").

But irradiation reduction problem is not the same for different regions. For example, in the regions where the concentration of uranium (radium) in the water-bearing rocks is not higher then the clark - there is no significant increase in water radioactivity. While high concentration of uranium in water bearing rocks is one of the main preconditions of the enormously increased water radioactivity. For the preliminary estimation of the problem scale the collection and integrated analyses of hydrogeological, geological and geochemical data for the European

part of Russia were undertaken. The main sources of the relevant information were the results of total uranium explorations that have been taken place many years before.

The main conclusions coming from the integrated analyses and data reassement were presented on the maps (scale 1:10 000 000) and interpretational schemes where main uranium-bearion zones are depicted. There are more then 23 different zones described in detail. Some of them are presented at a scale 1:1 000 000 and 1:500 000. Among them the most significant and well-studied are the following anomalous zones: Podmoscovnaya, Centralno-Voronezhskaya, Zhigulevsko-Pugachevskaya, Dono-Medveditskaya, Rostovskaya, Severo-Kavkazskaya, Verkhne-Kamskaya. Of the course all of them have on its turn rather complicated inner structure dealing with the distribution of radioactive elements in the subsurface.

The result of the study can be used as a theoretical basis for the future target oriented investigations within above mentioned zones to save future water-users from the potentional threat.

URBANIZATION AND GROUNDWATER RESOURCES IN LITHUANIA

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Groundwater is the sole resource of drinking water in Lithuania Most of the well fields are concentrated in urban areas or are. surrounding these territories. However, cities have a negative impact on the quality of groundwater< especially on shallow one. Many of Lithuanian's urban residents drink water from dug wells. Moreover, polluted shallow groundwater contaminates deeper aquifers of fresh drinking water. Therefore, this situation should be controlled and managed, as far as possible.

Vilnius municipality, Lithuanian Republic, is revising the general plan of city development. Different environmental scenarios of the city's growth possibilities have been evaluated. One of the most serious problems limiting the city's growth is water - resources protection. The shallow water - table aquifer is vulnerable to pollution almost everywhere, so it needs be highly protected where it is utilized for water supply or where it is replenishing deeper exploited aquifers. Eighteen to nineteen groundwater intakes are operated within the limits of the city and its suburbs. The principal artesian aquifer in the central and southwestern parts of the town is fairly vulnerable to pollution. The results of investigation and simulation indicate that anthropogenic pollution in the central part of the city (the old town) and in industrial districts (A.Paneriai) occurs not in the shallow unconfined aquifers only but in the deeper confined ones as well. In an effort to protect the quality of water resources of the city and to prevent their deterioration, two types of areas that could impact city growth are proposed that integrate various natural and anthropogenic factors: 1)most beneficial and suitable for city growth; 2)unfavorable and unsuitable for this purpose.

The first type is most favorable for city growth of any kind. In unfavorable areas, only civil construction (in some places limited) would be allowed. Reconstruction of already - developed areas is not recommended here. Areas of acute, conflicting environmental constitutions, where urgent measures to improve water- resources protection are presently required, have been designated "unsuitable for city Growth". Development of the second type of areas in all cases should be preceded by detailed hydrogeological evaluation of the area.

In order to evaluate the quality of the shallow groundwater in another urban area and to create an optimal monitoring systems, an original methodology for groundwater mapping has been proposed. It resembles the GIS (geographical information system) technologies.The set of maps, laid one over another, consists of the following: 1)urbanization map; 2)geological - hydrogeological map; 3)groundwater chemistry map; 4)resulting groundwater chemistry factorial analysis map; 5)pollution and pollutant transport map. The data obtained from studies on dug and geotechnical wells have been used for compilation of the maps. The systems for shallow groundwater monitoring in the city with an area of 70 sq km and a population of 140,000 is proposed to consist of about 30 monitoring wells and several dug wells.

GROUND WATER ACIDIFICATION IN RUSSIA

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Precipitation is the main component of ground water balance. Persistent contamination of snow and rain manifested itself in the water quality deterioration of rivers and lakes in Russia on a regions of European part of Russia, an analytical treatment of variation in ground water quality over space and time was perfomed. Subsequently, a comprehensive research was carried out for a number of water catchments, differing by geological, hydrogeological, and landscape conditions as well as by the degree of human impact on the environment. The research comprised an investigation of rain and snow chemical composition, along with their transformation in soil and aeration zone, an different types of hydrogeological regimes.

Inasmuch as for separate water catchment areas, the acidification processes were in different stages of their development, it was necessary to investigate the response of water-bearing rocks to the acidification. Therefore, the character of buffer action, as well as the kinetic properties of the process were studied under conditions of excess content of certain ions (i.e., hydrogen, sulfate and other ions), taking into account mineralogical characteristics of the rocks.

Investigations of many years and their analytical treatment made it possible to establish that the acidification showed its multiple-factor character and permanent intensification for all kinds of water catchments, being particularly pronounced for for-

est landscapes. The process may be subdivided into three stages. During the first stage, a steep rise of calcium, magnesium, and hydrocarbonate concentrations occurs in the ground water chemical composition (up to 300-400 mg/l of HCO_3 and 100-190 mg/l of Ca^{2+}). During the second stage, a reduction in concentrations of many ingredients occurs and, during the third stage, Ca, HCO_3, and Mg concentrations are established below their initial levels. At this final stage, sulfates begin permanently predominate in ground water composition, i.e., the hydrochemical water type is transformed from a hydrocarbonate to a sulfate type.

This research has been carried out with support of Russian Foundation for Fundamental Investigations (Project 94-05-16449).

UNDERGROUND WATER OF GEORGIA

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Report deals with matters of underground waters of the Republic of Georgia (natural resources and debits of fresh and mineral waters); ecological state of underground hydrosphere; ways for its amelioration; displays data on the present day and perspective demand in drinking and technical water; gives economical potential of utilization of abundant underground waters reserve.

Brief information on considered matters is presented below.

1. Natural resources of fresh underground waters of Georgia amount to several million cubic meters daily. 25% of this amount is proved.

2. Natural resources of mineral water make several milliard liters annually. Proved volume - about 10%.

3. Underground hydrosphere of Georgia is presented by shallow and deep circulation waters. Shallow circulation waters are more sensitive to anthropogenic factors. This influence is the most serious in regions with aeration about 3-5 m, or regions where ground waters horizons are not protected by protection cover;

4. Influence of antropogenic factors on certain regions with deep circulation waters is also fixed. This is more evident in the regions where water collectors are deprived of water-resistant roof or are covered sporadically.

5. Analysis of data obtained for the samples from 500 water points, situated in the hydrogeologically strained regions of Georgia reveal rapid decrease of toxic elements in soils. Decrease is proportional to distance from the source of possible pollution. For underground waters this effect occurred at comparatively larger distances.

6. Ways of localization, reduction or elimination of possible negative influence of antropogenic factors on the state of hydrosphere are fixed. Specific attention is drawn to the regions of formation and distribution of underground waters, which are aimed for utilization in future.

7. Taking into account renewability of underground waters of Georgia, and basing on he present day state and perspective water consumption, rational utilization of abundant water resources will be beneficial for improvement of national economy of Georgia.

PECULIARITIES OF INVESTIGATION AND ESTIMATE OF THE PRESENT DAY STATE OF UNDERGROUND WATERS OF GEORGIA

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Present day economical and lawful state of Georgia call for specific approach to the problems of utilization of underground waters. Solution of the mentioned problem requires: stretching of quality and ecological control of underground waters; perfection of hydrogeological and hydrochemical research; revealing and estimation of individual versions for realization of exploitation possibilities of underground water deposits; study of the state of underground waters with calculation of exploitation reserves and estimation of possibilities of realization of certain projects of utilization of deposits taking

into account international financial, economical and juridical statements; elaboration of business-plans for utilization of underground water deposits, drawing in foreign partners and investors.

Wide range of works foreseen by the program for investigation of underground waters is under way. These works are carried out at the labs of the firm GAMMA at the premises of Geological Institute, Georgian Academy of Sciences. Research works are carried out in obedience with requirements of the World Health Organization (WHO) and Declaration of specialized council of European states. The list of works comprise: ecological, hydrogeological and hydrochemical appreciation of deposits; investigation of physical, physico-chemical, chemical and sanitary indexes of waters; determination of ecotoxicants of all group of danger; etc.

More than 300 probed taken from various sampling points (springs, wells) have already been studied. Unique information bank created basing on obtained data contains scientific and commercial programs. Computerized data bank enables to accomplish statistic processing of obtained results; computerize modeling of water quality; elaborate integral characteristics of chemical composition; nominate associative groups of rationing elements and grading of waters; fix background and priority hydrochemical indexes of water quality; determine migration forms of chemical elements in water; compose maps of water objects; create maps of pollution sources and estimation of technogenic load of deposits; create maps of ecological guarding of underground water deposits; create the most efficient net of water points for organization and functioning of monitoring systems; analyze potential markets for production; analyze marketing activities; etc.

Business plans for utilization of certain underground water deposits are composed.

POLLUTION OF COASTAL AQUIFERS BY SEA WATER UNDER COMPLICATED HYDROGEOLOGICAL CONDITIONS

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In many coastal areas the intensive exploitationof ground waters due to drastic increase of economic activity led to reduction of water resources and intrusion of salt waters into coastal fresh water aquifers.

It is urgent to study the regularities of distribution of sea salt concentration in coastal aquifers under complicated gydrogeological conditions, when highly transmissible anisotropic layers are overlaid by polypermeable sedimentary rocks and the boundaries between them have an arbitrary form. Aquifers can contain some compact geololgical formations of natural or artificial origin of different permeability.

Sea water intrusion into ground aquifers is a complicated hydrodynamic process of joint movement of fresh and saline water different in density and other physical properties. The processes of dispersion, diffusion and convecive mixing of liquids take place in a transit zone from fresh to saline sea water. The most general mathematical modes used to describe the process of sea water intrusion into fresh coastal nonuniform aquifers is a system of filtration equations and convective diffusion of dissolved salts. The suggested model of intrusion is based on a generalised law of liquid filtration, the density and viscosity of which depend on concentration of dissolved solids, can describe both confined and unconfined flows of ground waters in nonuniform and anisotropic aqufers. The hydrodynamic model of intrusion in vertical cross-section of a coastal aquifer is mathematically expressed as a system of equations relative to fresh water head and concentration of sea salts in ground waters. The worked out model was used to predict the intrusion in coastal areas of the Baltic artesian basin. The conducted investigation of intrusion in nonuniform layers of the Baltic aquifer testified that the formulated model of intrusion and its numerical solution contribute to effective simulation of complicated hydrogeological conditions and development of measures aimed at water consumption management in coastal areas and allow to protect ground waters from pollution by sea waters.

The conducted study was supported by the Russian Fond of Fundamental Researches. Grant 96-05-6591.

NEW REGULATION ON THE PROTECTION OF GROUND WATER IN RUSSIA

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1. Ground water is one of the most important life-supporting natural media. Aquifers are protected against hazardous anthropogenic impact better than other natural sources of water, but, nevertheless, the state of groundwater is becoming worse. Over 200 new sources of contamination of fresh (drinking) groundwater are localized on the territory of Russia during the 1992-1994 period. Some of the sources even in case if the penetration of contaminants has stopped, can, as it is predicted, be preserved for hundreds of years. This determines the necessity to regulate the order of usage of groundwater and the requirements on its protection on the state level.

2. The state legislation in the field of use and protection of water has been changed not once. The recent basic legislative acts in this field are "Water Code of the Russian Federation" and "The Russian Federation Law on the Earth's Interior" (1995). Basing on these and other nature-preserve laws, a project of a new regulating document has been prepared - "Regulations on Groundwater Protection". In accordance with the existing legislation, this project states the following:

- protection of groundwater is referred to the most important tasks of the country and society;
- groundwater as a part of the earth's interior is a state property and can be used only at special permission - licenses;
- priority use of fresh groundwater is implemented for drinking purpose, mineral water - for curative purpose;
- the reserved sources of water supply should be made on the basis of the groundwater, protected against pollution;

it is necessary to make an estimation of an impact of man's activity on groundwater, which is carried out within OVOS and state environmental expertises;

- arrangement and implementation of groundwater monitoring at the objects that affect groundwater and others.

3. The following items of the regulative-methodical documents require to be elaborated in more details and more strictly regulated:

- specification of concepts "boundaries of underground water objects" (boundaries: geological; between underground and surface waters; administrative territories; intercountries);
- individualization of underground water sources: distinguishing them among other objects of the subsurface for the purpose of rational use and protection;
- use of groundwater (earth's interior) when it occurs jointly with other useful minerals;
- the order of the use of groundwater in complicated or questionable cases (quotes for water extraction, etc.);
- scientific-methodical and regulative support of water-protective activity, including: introduction of ZSO for water-intakes in complicated conditions and substantiation permitted types of activity in ZSO, criteria for the location of objects from the view of groundwater protection, assessment of damage given to groundwater due to joint impacts on it from several sources of contamination and so on;
- development of methods for the management of the quality of groundwater.

THE BASIS OF AN OIL-POLLUTED GROUND WATER DECONTAMINATION PROJECT

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Free oil products layer on free surface of subsoil water is typical for ground water oil contamination. This layer usually consists of processed hydrocarbons like petrol, diesel oil, or kerosene. Contamination of the kind rises, as a rule, on the territories of big oil refineries during the long years of their functioning. These floating oil pollutants mount up to several square kilometres in area with the thickness up to several metres.

The report is dedicated to the formulation of the problem, numerical method for its solution, and also the results of simulation of oil lens migration over subsoil water surface. The mathematical model of non-stationary 2D filtration for two liquids of different densities was applied in the assumption of verti-

cal hydrostatic equilibrium. The model comprises two interconnected quasilinear parabolic equations with two unknown functions of water and oil pollutant pressures.

The simulation was carried out according to the model in two versions: for two immiscible liquids with sharp interface, and for the oil lens considered to be a two-phase zone of water-oil mixture.

The model takes into account different regimes of filtration in the aquifer: free surface filtration, hydraulic head filtration, and mixed regime. Supply and discharge wells, infiltration, flows across the boundaries, interaction with surface reservoirs and waterflows, drainage and discharge into springs are also kept in mind.

The computational model is based on the finite differences method with completely implicit differential scheme for both pressure functions. The system of linear algebraic equations corresponding to every time slice should be solved with iterative strongly implicit procedure (SIP), the calculated zone may be arbitrarily shaped.

A set of programs for PC486 was developed, which enables interactive data input with the help of a graphic editor, verification, viewing results in course of and at the end of simulation, interrupting and resuming the procedure, saving results and producing hard copies.

The program set was applied to simulation of migration of an oil lens over subsoil water surface under an oil refinery near the Volga river. Starting from compiled observation data, the inverse problem was solved and, thus, the permeability and filtration coefficients as well as hypsometry for the natural ground water flow have been derived. The results combined with measured oil lens thickness have permitted to solve the lens formation and migration inverse problem and, particularly, to evaluate oil seepage. The lens evolution over the last 30 years was restored; different interception patterns to prevent the river oil pollution were tested. As result, one of the patterns envisages formating a funnel on subsoil water surface.

ABOUT THE HYDROGEOLOGICAL BASIS OF THE GEOLOGICAL PASSPORT OF THE ADMINISTRATIVE REGION

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The geological passport of a region - technical document, including item of information about physico-geographical conditions of territory, a geological structure, hydrogeological and engineering-geological conditions, about dangerous natural and technogenic-natural processes, data on use of regional resources (natural and secondary) and valuation of influence of manufactures on geoenvironmental and being by a element of ecological monitoring.

Main section of the passport - characteristic of a hydrogeological conditions, which defines not only condition of a water-supply and use of mineral resources, but development and possible anthropogenical activization of dangerous geological processes (water-tableware, karst, suffusion, landslides and other). So only unattended exploitation (use) of underground waters promoted to result to tens negative of consequences.

Prime problem at drawing up of base of the passport - collection, ordering and analysis of materials on geomorphology, geology, hydrogeology, geochemistry, engineering geology and hydrology of region. Valuation of researches thus expediently to conduct on standards of the middle and large-scale mapping, in regions intensive industrial of a load- 1:25000 - 1:10000. By results of the first stage a complex of special maps of geological environment, determining The nearest problem of researches, their necessary and perspective directions is made, and are carried out control routing observations. Thus the special attention is given to valuation contamination and protection of underground waters, conditions of a water-supply and possibility of use of mineral waters, melioration and hydraulic engineering structures, conditions of accommodation of polygons of firm household and toxic industrial wastes, radiating conditions, activity of development of hazard geological processes and etc.

As a result of researches are defined main qualitative and half-quantitative (in numbers) criterion of valuation of stability of geological environment (Trofimov and etc., 1994): morphology and energy of relief, type of a geological structure, structure and properties of soil geodynamic conditions, ydrodynamical and hydrochemical parameters. Geoecological the passport becomes the basis at development of the design documentation on economic development of a region and use of its resources, defines the program of engineering-ecological researches and proposals (recommendation) on organization regional and local ecological monitoring. A main branch the last is monitoring of hydrosphere, the most mobile part of geological environment.

STUDY AND EVALUATION OF CHANGES IN THE GROUNDWATER ECOLOGICAL CONDITION IN REGIONS OF INTENSIVE INDUSTRIAL ACTIVITY, WITH THE COMPUTER TECHNOLOGY BEING USED

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Here the change in the groundwater ecological condition in hydrogeological systems refers to the technogenic changes in the natural composition and properties (salinization, contamination, temperature rize, et al.) of the upper groundwater, which decrease, as a rule, its value as a source of drinking water supply or for use of other type.

In many densely populated regions of our country with intensive industrial activity and groundwater exploitation the situation with the groundwater quality may be characterized as unfavourable. Already existing pollution of groundwater and fast rates of its contamination lead here to a sharp drop and shortage in high-quality fresh groundwater resources.

For coming out from the arisen situation of crisis and as one of the first steps in solving the problem under consideration, the report suggests the procedure for studying, estimating and predicting changes in the groundwater ecological condition as sell as the computer technique for solving these problems, which is based on the system of mathematical models of groundwater flow and solute transport for regions (objects) of strained water balance, intensive exploitation, and deterioration of the groundwater quality.

Principles for creating complex systems of combined groundwater flow and solute transport models of different scale for such regions have been considered as well as quantitative solutions to the main tasks of calculating variations in the groundwater ecological condition and longterm prognosis of these changes. Data on variation in the location of groundwater of different composition in the system of aquifers and low-permeability aquitards, as well as volumetric data on water of different composititon coming into the aquifers or taken out through all boundary contours, and that contained in aquifers and dividing layers as varying during the periods of epignosis and prognosis for different variants of the prediction are the main results of such works.

Evaluation and prognosis of the change in the groundwater geoecological condition have been fulfilled, using considered procedure, for the Plain-Crimean artesian basin, with the system of regional combined groundwater flow and solute transport models of the basin being the basis. The following results have been obtained: data on volumes of water of different mineralization recharging the aquifers or taken out through all boundary contours; data on variation and location of zones with different mineralization of water contained in the aquifer during the whole past period and that of prognosis.

Results of investigations of the changes in the groundwater geoecological condition for the Central part of Novomoskovskiy industrial region (Tula) based on the developed system of groundwater flow and solute transport models are reported also. Changes in the groundwater geoecological condition caused by water intakes and other influences (mines, pollution of the surface hydrosphere et al.) have been quantitavily investigated.

EXPERIMENTAL-TECHNOLOGICAL INVESTIGATION AT PROSPECTING AND EXPLORATION OF DEPOSITS OF UNDERGROUND WATERS FOR A WATER-SUPPLY

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The underground waters can not be as often as not used for economic and especially - for drinking of needs because of discrepancy of any components of their compound (iron, manganese, nitrates and other) normative requirements.

At realisation of searching- estimated and prospecting work on deposits drinking of underground waters, used for drinking of needs of the population, as a new independent kind in a complex prospecting of work by us are allocated experimental- technological researches. A role of these investigations, alongside with experimental-filtration and experimental-migration researches increase in accordance with deterioration of a natural compound of underground waters and in regions of square of their pollution.

At scheduled on project of a stage use of technology of purification of underground waters directly in situ experimental-technological tests in a complex prospecting of work at the stage of investigation should be certain.

Since 1989 in Priamurie on a number water supply technological researches on purification of underground waters from iron and manga-

nese in aquifer, as on one wells, as on many wells installations were executed. The experimental-technological investigation on purification of underground waters from iron and manganese in situ on a deposit are since 1993 conducted, where a structure large water supply of underground waters is scheduled.

OIL CONTAMINATION IN GROUNDWATER: MEASURES FOR LIQUIDATION

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Contamination with oil is one of the key problems to be solved for aquifers in the meantime and in future.

Contamination corresponds to airports, petrol pumps, fuel tanks, oil pipelines and other sites where hydrocarbons are used.

Most hydrocarbon mixtures used as fuels are characterized by the following features: relatively low water solubility, lower density and ability to wet the rocks if compared with the same characteristics of water.

The features are responsible for accumulation of oil contamination forming lenses over aquifer with definite water-oil interface.

Sometimes the lenses are large enough having dimensions up to several miles. The oil contamination lenses cause prticular risks for aquifers, surface water bodies, facilities, and thus for people.

The contaminants must be pumped out. However, pumping with intuition only but without calculations fails quite often.

There are concepts describing oil contamination percolation through aquifer.

The concepts allows to estimate the effectiveness of contaminant extraction from aquifers. Unfortunately they are not widely applicable due to lack of necessary quantitative data on rocks-water-oil system interactions.

The developed oil contamination models consider water and oil as immiscible fluids having different densities and abrupt interface. The model describe groundwater flow with the system of Boussinesque equations. The developed and tested numerical model will help to solve wide spectrum of problems concerning oil contamination extraction for groundwater quality rehabilitation. The model is applicable for setting locations of pumping and observation wells, their depths, pumping rates, and water pumping combined with extraction of contaminants.

PROBLEMS OF THE GROUND WATER USE OF WEST SIBERIA

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Investigations of the West Siberian ground water, including their resources, were unevenly performed. The southern part, except for the areas of cracked and cracked-veined water of mountains - Gorny Altai, Kusnetsk Altau and Salair received the most study.These areas as well as eastern slopes of the Urals are comprised into the territory, which is beyond the distribution of the artesian basin of West Siberia.

The production geological amalgamation estimated regional ground water resources of the most studied areas of the Tyumen (southern and central parts), Tomsk (left bank of the Ob river), Novosibirsk, Omsk, Kemerovo, Pavlodar and Altai regions, as well as of Kockchetav and Semipalatinsk, now attributed to Kazakhstan. The predicted exploitation resources of fresh (mineralization less than 1 g/l) and saline (mineralization 1-5 g/l) ground water, suitable for drinkable water supply or pasture watering were estimated as 174,582 cbm/day on the range C1 and C2 and aprobated in the State Resources Commitee for 50-year exploitation period. In addition, before the estimation of regional resources, the State,- Territory,- and Novosibirsk Resource Committees estimated exploitation resources as 8568,7 cmb/day. Of this quantity 5011,3 cbm/day were scaled on well studied ranges (A+B). Thus, total exploitation resources of fresh and saline water of the most studied parts of the Ob river and West Siberian artesian basins of the men-

tioned territories and regions (area covers 118,7 thnds square km) make up 183148,3 cbm/day (Semskova I.M., Smolentsev Yu.K. and Polkanov M.P.). For tentative estimation of exploitation resources of fresh ground water of the total West Siberian artesian basin empirical ratio of natural and exploitation resources, obtained for the most studied southern area of the basin has been used. Extrapolating this ratio on less studied areas towards the north and east, minimal predicted exploitation resources of fresh water were estimated as 318436 cbm/day with unlimited exploitation period for the total West-Siberian artesian basin. Without considering the most upper of eastern slope of the Urals and the Ob river ground water resources in China (Black Irtysh), this estimation should be added by the predicted exploitation resources of mountains (Gorny Altai, Kusnetsk Altau, Kolivan-Tomsk zone and Salair), tentatively estimated as 11750 cbm/day.

Thus, the predicted minimal exploitation resources of fresh ground water of the whole Ob river basin are estimated as 330186 cbm/day. Presently existed extraction of fresh ground water is also uneven throughout the territory, but as a whole it is not high, making up only 1-2% of the predicted exploitation resources of the ground water. Thus, the ground water reserves of the Ob river basin are considerably great.

In the Tom river basin (Kusbass) due to many-year development of many coil deposits (mines, deep quarries - hundreds of meters) the vast depressive funnels were formed in some regions, that caused the disappearance of about 150 small rivers (with the extension of 100 km and less) in the Tom river basin.

PREDICTION OF THE DEVELOPMENT OF KARST-SUFFOSION PROCESSES IN THE MOSCOW CITY AREA AS A RESULT OF ANTROPOGENIC CHANGES IN THE HYDROGEOLOGIC ENVIRONMENT

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The Moscow city area can serve as a typical example of the activation of karst-suffosion processes due to long-continued exploitation of karst water of Carboniferous deposits and lowering their levels and head pressure by some tens of metres (Kozhevnikova, 1984; Kutepov and Kozhevnikova, 1989). The karst-prone rocks here are Carboniferous limestones and dolomites occuring sometimes at depths greater than 50-70 m under the sequence of insoluble rocks of Mtsozoic-Cenozoic age. The carbonate rocks are intensively and non-uniformly karsted, which shows in their considerable faulting, the presence of numerous holes of various demensions open or filled with residual colmatage formations of Paleozois or later age.

The colmatage formations exibit sand lenses of Quaternary. Owing to the modern technogenic impact the solubility of the carbonate rocks has been considerable redused. However, the depressed levels and heads of karst water favour the development of suffosion and other filtering processes that alter the state and properties of the karsting rocks and the overlying sandy-argillaceous formations, thus causing, sinks and subsidences of the Earth's surface.

Many years of the stady of karst deformation subsidences and sinks on the territory of the city carried out with the traditional and special, including geophysical, metods have indicated that the subsidences and sinks owe their occurence to early times and arise mainly in the areas of the pre-glacial valley where older, weakened zones are evident. Prior to the uptake of the karst waters, when their piesometric levels were above the groundwater levels, these areas were involved in the discharge of confined karst water and a recharge into the groundwater flow. As the head of the karst water had been reduced the upward filtering gave way to downward filtering in the areas of the slopes and thalweg of the pre-glacial valley where the poorly permeable Jurassic clays where washed out.

At present the process of downgoing filtering is developing most intensely. Discharge has resulted in the karst water table being no longer in karst water table being no longer in contact with the confining bed and a space devoid of water being formed in the upper part of the sequence.

In the presence of the nonuniformly distributed hydrodynamic load, the overlying sandy-argillaceous Mesozoic-Cenozoic deposits along the steep slopes and bottom of the preglacial valley tend to move towards the karst strata of carbonate rocks. In 1969 two slump holes were formed here and ander the building and caused the failure of a part of the building. A detailed study of these slump holes led us to a conclusion that the cause of the sinks was the intense outpumping of karst water, decline of its head by tens of meters and redistribition of the head. As a result, the direction of groundwater streams was altered and a vertical downgoing filtering occurred that caused an intense development of filtration processes disturbing the state and properties of the rocks. The development of these processes and the associated deformations is not a

chance play as precisely this area is characterized by zone where such processes took place at earlier stages of the geologic evolution of the area.

The investigation of the stress state of the rocks in the area provided an insight into the mechanism of the formation of the slump holes. This mechanism proved to be of the gravity-suffosion type. The analysis has led us to prediction of the possible formation of similar sinks, further alteration of the groundwater levels and an increase of the gradients of vertical filtering.

ENVIRONMENTAL-ECONOMICAL ESTIMATION OF GROUND WATER DEPOSITS

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When organizing water-supply schemes on the decision-making level the environmental interests are not taken into account. Especially it concerns the ground water. Ground water rates should stimulate rational water-selection and must be differentiated according to water-bearing horizons. Scientifically stated realization of the principles mentioned in the course of creating multipurpose *programs on nature utilization may* be provided by ecologycal estimations of underground waters enabling to generalize and systematize different parameters of hydrogeological systems. Therefore the purpose of underground water economical estimation is not only is presenting water intake in the form comparable with other elements of society economic activity but also in comparing the value of aquifers between themselves in dependence of their ecological state.

A method of step-by-step assessment of ground water deposits is proposed in the paper.

OIL CONTAMINATION OF GROUNDWATER: SCALES, TECHNIQUE OF DETECTION, MONITORING, SUBSTANTIATION OF PROTECTIVE MEASURES

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Oil contamination is one of the most widely met types of contamination of groundwater in Russia (taking the 5th place by occurrence). In some regions it has a serious threat for domestic water supply. About half of the detected contaminating sources contain oil products in water in 10 times higher amounts than the maximum allowable level (MAL). In cases of spill and leakage of oil products in the sites of their storage and treatment, the area of oil contamination covers, as a rule, not more than 3-5 sq. km, whereas in the sites of exploited oil fields it may reach tens of sq. km.

A complex of express and economically effective non-traditional methods was developed and tested for detection, evaluation of scales of oil contamination, and for substantiation of protective measures. Among them are atmo-geochemical (gas) and soil-rock surveyings, field gas-chromatography and luminescent-bituminological investigations, identification of contaminants and other methods enabling in-situ conditions: to localize in groundwater the lenses of oil products; make a preliminary evaluation of the area contaminated by water-soluble and gaseous hydrocarbons; detect the sources of contamination (including secondary); substantiate the installation of an observation network.

The use of the technique makes possible to start already at the phase of exploratory works the implementation of top-priority protective measures on localization of oil- and oil-products lenses in groundwater. The developed experimental- exploitation approach gives the possibility to: combine the works on experimental filtration and experimental migration with pilot pumpings of contaminated groundwater; estimate the real time of tightening of contamination contour; calculate the filtration and migration parameters of contaminated areas; carry out with appropriate grounds the geofiltration and geomigration modeling. As a final result, all this considerably shortens the investigating phase and

increases the reliability of engineering solutions on liquidation of contamination.

The environmental monitoring programs should be prepared taking into account the compound nature of oil-product contamination (i.e. contamination involves the soils of the unsaturated zone, water-bearing rocks, groundwater, soil air), variety of migration forms of hydrocarbons. The observation network should be designed to provide the possibility to control the state both groundwater and soils of the unsaturated zone, as well as to fix insoluble, soluble and gaseous hydrocarbons.

PROBLEMS OF UNDERGROUND BRINES IN DEEP MINING

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Deep mining is often connected with intensive upconing of underground brines to drainage systems and an appropriate contamination of water pumped out by these systems. So, great amounts of contaminated (salt) water have to be utilized at the surface resulting in serious environmental problems.

The kimberlite pipes in Yakutia are mined by deep quarries. Under permafrost zone of thickness about 200 m collectors with brines are being crossed by quarries; the brines are related to the carbonate aquifer of thickness about 150-200 m. Total solids content in brines accounts for 100 g - 300 g per litre, their inflows to quarries amount to 1000 m/h. The lack of efficient technology for utilisation for brines pumped out by drainage systems contributed to the deterioration of environment (surface water, in partucular) in the region. This problem can be solved in two principal ways.

The first way is concerned with construction of deep injection-type curtain for isolation of quarry from brines. The curtain of more than 300 m deep and with extension of about 3 km (along the quarry perimeter) is constructed under permafrost zone at MIR quarry by injection via-wells of the special clay-cement mixture penetrating into fractured rock by 10 m - 20 m or more. It was supposed that this curtain will reduce the original permeability by two-three orders of magnitude - from some few meters per day to several hundreths m/d; thereby, the volumes of pumped out brines should be reduced by three or four times.

However, the effeciency of the curtain seemed most questionable (Mironenko, Atroshchenko, 1991). Because of that a set of aquifer tests and observations has been developed to assess the quality (low permeability) of the constructed curtain. We have proposed also an additional cementation of rock within the curtain area by fresh water injection and its subsequent freezing because of the natural negative temperatures in brine-bearing collector. This method was not used however until now.

On the whole, field experiments and observations have not proved the supposed efficiency of the curtain.

The second way is concerned with the subsurface reinjection of brines. For this purpose the same carbonate collector can partially be used, at the distances of several kilometers of the quarry as it is done at the MIR open-pit. On the other hand, at UDACHNAYA open-pit, due to low storage capacity of brine-collectors, the main volume of brines is supposed to be recharged into carbonate-clay rocks of permafrost zone. With due account of brines-capacity to dissolve ice in this rocks their potentially free porosity is measured by some percent. The performed hydrogeological forecasts show the possibility to dispose practically the whole mass of pumped out brines into the permafrost zone - without essential environmental damage. The carried-out test-exploitation works at experimental site completely confirmed this forecast. It is necessery, however, to obtain the maximum use of permafrost zone storage capacity in order to prevent the brines rather quick penetrating into the main collector (positioned under permafrost zone). For this purpose the brines recharge is accomplished via systems of shallow wells. A wide areal propagation of brines within the permafrost zone of great thickness is attributed to high profil anisitropy and non-uniformity of its flow-properties. Due to the layered structure of permafrost zone the brines move laterally over the distance of some kilometers from the injection site, gradually sinking to lower horisons of the permafrost zone as a result of leakage processes. On the basis of hydrogeological (flow and mass-transport) forecasts recommendations are suggested for the ground water monitoring system.

TECHNOLOGY OF KUSBASS UNDERGROUND WATER CONDITIONING FOR POTABLE WATER SUPPLY

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An ecologically destructive development model as well as lack of appropriate information about the necessity and methods of protecting water resources have resulted in the deficiency, destruction and growing pollution of fresh water sources practically in all the regions of Russia.

In the circumstances one of the most expedient ways of providing people with good quality potable water is the use of underground water showing greater resistance to climatic conditions, much better protection from pollution, the stability of quality over a definite time period, which allows to obtain conditioned potable water with less expenses, water intake stations being situated close to the consumers.

In Kusbass where the main water way the Tom river has been abandoned as a fish source due to the severe anthropotechnogenic influence the proved reserves of underground water according to the data of West Siberian geologic committee make up about 1,5 mln. of cubic meters per day, the actual demand amounting to 1,7 mln.

The present paper gives the results off investigations aimed at finding out the possibility and efficiency of underground water use for potable water supply in Kusbass.

A number of the most typical for Kusbass underground water sources both depending on the condition of the Tom river and having no connection with the surface water have been surveyed. To carry out the control of quality 48 indexes were taken into account. It has been stated that on the whole the quality of underground water meets the existing GOST requirements (2874-82 "Potable water"). At the same time an excess in permissible concentrations of iron, manganese, phenols, suspended substances has been noted, in some water sources the presence of hydrosulfur has been recorded as well.

To develop a universal technology of conditioned potable water preparation on the basis of underground sources some laboratory and outdoor investigations have been conducted. The mentioned technology either as a whole or with some water purification stages excluded can be employed for water supply using underground water of any composition.

It has been studied how the oxidant used (air, oxygen, ozone, sodium hypochlorite) affects the efficiency of oxidation, coagulation and disinfection processes, how primary clarification influences filtration and sediment recirculation as well as what effect the place of the reagent entry produces on water purification. The sorption of organic impurities by means of absorbent carbon and polymeric sorbents of the "polysorb" and "porolas" classes and the effect of the reagents introduced during water preparation on sorptional purification efficiency have been analyzed.

The key pattern and distinctions of underground water preparation depending on the composition of impurities, reagents and materials used have been studied. The reagents, materials and regimes for each stage of water preparation have been selected to ensure the highest efficiency of purification.

The given technology was tested in the water intake station "Pugachi" on the industrial experimental plant having 1 m^3/h capacity and designed to purify underground water containing hydrosulfur, manganese, iron, phenols and suspended substances in quantities exceeding the permissible levels. The quantity of purified water is stable and corresponds to the standards of World Health Organization.

OUT-CONDUCTOR THERMOPROBE FOR EXPLORATION OF GAS AND GEOTHERMAL BOREHOLES AND WELLS

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Out-conductor thermoprobe ZTZ-100M is intended for exploration of low-diameter boreholes (from 1"), including temperature determinations in out-conductor space of gas-wells through satellite line on depth down to 500 m, with automatic registration of temperature-determination results and

with automatic construction of temperature section. It is fit, too for exploration of geothermal wells with simultaneous determinations of temperature and well fluid ttal mineralization on assigned depths.

The thermoprobe ensure:

- digital readings temperature determination results in °C with indication of hundredth parts of centigrade and sign;
- digital readings of probe immersion depth in meters with indications of tenth parts of meter;
- registration and storage of parameter values into operative memory unit;
- output of information through successive interface RS-232c.

There is provided installing of electrical conductivity channel into borehole thermoprobe with automatic total mineralization computation.

The probe includes borehole unit, microprocessor control unit and cable winch with electric or handle drive.

Borehole unit include temperature sensor TSP-200 (and, optimal, conductivity sensor and measuring converter signal frequency code.

Control unit includes:

- coupler, realizing coupling of control unit with outside units;
- control desk panel with light-diode seven-segment indicators;
- microprocessor, controlling unit functioning, data processing, memorizing and displaying.

Control unit tructure is rather flexible for quick re-adjusting its functioning order (size of the measurement intervals, sequence of memorizing determinations results, values of graduation coefficients).

There used universal cable winch MLK-500 for descent-ascent operations. This winch, designed by NPF "Dipole", is used by hydrologic investigations with the id of small water-crafts, ecological stations as STAM, ad by geothermal and gas-wells investigations.

The winch include cable-drum (with cable-layer) for 500 m cable (6 mm diameter). Winch's drive is electric (220 V, 50 Hz or 24 V direct current) or handle.

Table. Technical data of the thermoprobe.

№№	Description	Unit of measurement	Value, range
1.	Measured temperature range	°C	from -10 to +40
2.	Absolute temperature measurement deviation ≤	°C	0.1
3.	Unit junior grade code value	°C	0.01
4.	Time constant of thermosensor unit ≤	sec	1
5.	Depth of probe dipping ≤	m	500
6.	Depth measuring range	m	from 0 to 500
7.	Depth measurement relative deviation ≤	%	1
8.	Depth measuring discreting	m	0.1
9.	Environmental temperature: - for borehole probe - for control unit	 °C °C	 from -10 to +40 from -40 to +40
10.	Relative air humidity by 25°C to	%	98
11.	Supply: - from 12 rechargeable batteries D-0.55C - from external power supply Consumption current: - by functioning ≤ - by information keeping regime ≤ - batteries recharging voltage from power unit	 V V mA μA V	 DC 15 AC 220 70 100 DC 20
12.	Mass: - control unit - borehole probe - cable meter - battery box with batteries - power unit	 kg kg kg kg kg	 1.0 0.9 3.0 1.2 0.7
13.	Dimensions: Borehole probe: diameter - length Control unit: length - width with socket - height	 mm mm mm mm mm	 23 495 150 120 120

UNTRADITIONAL MEASURES FOR GROUND WATER PROTECTION IN ZONE OF DOMESTIC AND INDUSTRIAL WASTE DUMPS

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1. In an excessive moisturing zone the danger of ground water pollution in dump area is especially high, because of the precipitation infiltration trough its body is added to their transit through the base of dump.

2. In case, when the isolation of dump base is hampered (long existing dump, complicated hydrogeological conditions etc.), it is necessary to create a system of vertical drains, by means of which not only ground water level is lowered and polluted water, that comes from the dump, is pumped, but also water, polluted in the dump exploitation before, is removed and sent to treatment plant.

3. Ash of HPS and other enterprices, especially if they use the system of hydroashremoval, can be used to reduce filtration trough the dump body and base. With this, additional effect is achieved - ash-dumps become empty.

4. The most dangerous for environment open toxic liquid waste depositories can not be conservated without liquid level lowering in them and further covering.

To achieve this, horisontal drains with heightened water intake ability are layed in protective dike of depositories, and collected liquid is sent to dilution station and further on - to treatment plant.

The water for dilution is got from vertical drains, built for pumping polluted ground water from depositary zone.

GEOPHYSICAL INVESTIGATIONS IN ENVIRONMENTAL HYDROGEOLOGY: PROBLEMS AND TECHNOLOGIES

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Water in the geological environment should be considered for environmental purposes from several points of view, i.e. as a mineral; as a source of feeding plants and living organisms; as a factor that determines mass- and energy-exchanging processes; as a tool for control of the state of the geological environment, and, finally, as a component providing the information on the exogenic and endogenic processes.

The possibilities of geophysics for this problem are connected both with the use of geophysical methods proper (exploratory geophysics) and the study and consideration of physical aspect of equilibrium, transfer, exchange of water and salts dissolved in it, organic substances, gases, etc. (so-called "big geophysics").

The problems of exploratory and general geophysics in environmental hydrogeology (ecohydrogeology) require the development of ecogeological geophysical models at different hierarchical levels: global, regional, local, detailed, rocks, mineralogical, molecular and submolecular. In this case, ecohydrogeological and ecogeophysical systems of different hierarchical levels should be considered chiefly as stable natural systems. With these systems being out of equilibrium due to anthropogenic impact, negative reverse links appear which lead the ecogeosystem to its initial or a new stable state. These systems can be named as conventionally cybernetic.

Least studied from physical (geophysical) positions are the processes of ground-water seepage through water-proof beds, moisture migration in the unsaturated zone, structural and reological properties of water, non-linear processes of ground-water flow and their connection with the gradients of temperature, salt content and electrical potential.

Basing on the concepts of ecogeological boundaries, bodies, systems, reserves and resistance, one can estimate the protective properties and select an allowable anthropogenic load on the geological environment at any types of impact.

Using the theory and technology of ecogeophysical investigations worked out at VSEGINGEO, the local and regional estimates were made for: the protective properties of the unsaturated zone in the conditions of depletion and contamination of ground water; the role of water in the formation of engineering-geological properties of rocks and in the stability of slopes; and effective complex of geophysical methods was developed for the purposes of: land reclamation; prospecting, exploration and replenishment evaluation of fresh ground water; assessment of permafrost state. The studied physics of movement of liquid thin layers provided the establishment of the role of film moisture while slow ground-water flow. There were developed a number

of geologo-geophysical models of different levels and appropriate technologies for solution of environmental geology tasks.

The top-priority problem to be solved in the nearest future is the development of monitoring geophysical technologies aimed to solve eco-geological tasks.

RADIOAKTIVITY OF THE UNDERGROUND FRESH WATER WITHIN PODMOSKOVNAYA ANOMALOUS ZONE

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Podmoskovnaya underground water radioactive anomalous zone spreads from Ryazanskaya through Tulskaya and Kaluzhskaya oblast till Smolenskaya oblast catching also southern and western part of Moskovskaya oblast and then turns to the north ending at the western part of Tverskaya oblast. The origin of increased radioactivity values is coming from the uranium shows in coal deposits of carbon age. The whole zone is depicted on the map at a scale 1:1 000 000.

Due to the large scale analysis it was found out that within this anomalous zone there are several more intensive (from the radioactive point of view) areas that have been studied more

thoroughly. Among them are: 1) Briketno-Zheltuhinskaya (Skopinskaya); 2) Serebryano-Prudskaya, 3) Mordveevskaya, 4) Aleksinsko-Venevskaya; 5) Yuzhno-Tulsskaya (Shekinskaya); 6) Sukhinichskaya; 7) Severo-Okskaya; 8) Ruzskaya; 9) Chiplyaevskaya; 10) Safonovskaya; 11) Belskaya; 12) Andreapolskaya; 13) Sichevskaya; 14) Rzhevskaya. Besides, there are some extra anomalous zones to the north from this main belt mentioned above.

In total within Podmoskovnaya zone there are 2 uranium ore deposits (Belskoye and Briketno-Zheltihinskoye). 14 uranium ore field shows, 152 uranium mineralization shows and 216 radioactive anomalies. Mostly radioactive anomalies in the underground water are of radon origin. But within Belskoy and Aleksinsko-Venevskoy areas there are several anomalies of radium origin with the activity up to 15-20 Bk/l in the underground water of carbon water-bearing horizon (that is almost 10 times higher then the existing level for the drinking water).For several anomalous areas (numbers 1,11,2,5) there are special geological and radiometrical models drawn at a scale 1:100 000.

But still to supply the necessary level of safety for water-users are a lot of things to be studied more thoroughly within Podmoskovnaya zone and in the vicinity of uranium ore deposits and large ore field shows in particular. As it was already demonstrated in several cases there are opportunities to manage environmentally sound and safe enough shemes of underground water use even in the vicinity of uranium ore deposits with the level of volume activity of radon up to 100 Bk/l.

The authors are open to any contacts with western experts and potential investors to manage the problem.

DEVELOPMENT OF METHODS OF COMPLEX GROUNDWATER QUALITY ESTIMATION

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Groundwater quality assessment is necessary for all types of hydrogeological investigations. The necessity increases for drinking water supply, water bottling and mineral water use. The existing conceptions of water quality assessment integrate requirements of medical men, biologists and customers. They are realized in the State Standard and the recommendations of World Health Organization. The development of scientific conceptions causes the increasing number of checked indices.

Besides the usual chemical analysis it is essential to carry out a total toxicological estimation of ground water quality. The investigations of St.Petersburg university showed that these methods can also indicate buffer power of water solution. For example, if to add the same amount of toxicant to soft and hard water, soft water becomes toxic and hard water remains suitable for drinking. The results of toxicological assessment of ground water quality of some regions are discussed.

The classification of water, taking into account the influence of water to human health should be elaborated. An increased concentrations of many substances in food can be harmful, but low concentrations of some elements can be also dangerous. So, absence or small amount of several biologically active components should be taken onto account during ground water quality assessment. These components are: Ca, Mg, Fe, Cu, Mn, Co, Zn, Mo, Se, Ni, As, I, F.

It is possible to distinguish water of extra quality. It is water with optimal concentrations of biologically active elements. It can be used for bottling. The deposit of drinking water of extra quality of North-Western part of Russia are considered.

Because of the complexity of water quality problems it is essential to broaden the cooperation of specialists in different fields of science. As a result, The new methods for multi-criterial assessment of drinking water quality must be developed. This assessment allows to establish the classification of water based on integrated quality parameters.

GROUNDWATER ECOLOGICAL STATE OF ST-PETERSBURG AND IT'S VICINITY

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In spite of the fact that groundwater of St-Petersburg region has been seeing as foundation for city's water-supply it is of grate value as reserved source of drinking water and source of water supply for satellites-twins. Besides the groundwater here is great importance as a part of environment, landscape description, medical means. The role of underground hydrosphere as alternative source of drinking water increases because of widespread contamination of rivers and lakes on one hand because of new state conception of central water-supply scheme - on the other.

A good way of groundwater state assessment is hydrogeological mapping. One of the variants of such mapping is working out a complete set of maps. The proposed set consists of four sheets and shows people-made pressure on the aquifers as well as quality, quantity and protectivity of the water.

Maps of the vicinity of St-Petersburg in the scale of 1:20000 have been accomplished by the Department. Two main hydrogeological sections can be chosen within the territory. To the North of the City the groundwater resources are belonged to Gdov sandstone. In the South part the main aquifer is Ordovician and Devonian rocks.

Gdov water-bearing horizon lies on the rough surface of Proterozoic foundation and is overlapped by clay and quaternary deposits. This artesian aquifer is being used for water supply.

Pollution is absent in the water but there are some zones that have high natural concentrations of iron, radon, fluorine. Selections with very good water quality can also be noticed as section where the water is convenient for bottling.

Ordovician and Devonian water-bearing horizons are situated to the South of the City. Ordovician Limestone has a thickness of 10-160 meters and has being used for water-supply of big towns for a long time. A lot of powerful water wells were built here. Devonian sandstone provides villages and small towns with fresh water.

The aquifers bedded within a territory of nearest suburbs of St-Petersburg, are very much worked and polluted. The ways of dissolving this problem are considered in the paper.

INTENSIFICATION OF THE UNDERGROUND WATERS USE AS ONE OF THE MAIN TRENDS CONCERNING IMPROVEMENT OF THE DRINKING WATER SUPPLY IN UKRAINE

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Worsening of the ecological situation in Ukraine brings large problems concerning supply the population with the drinking water of the appropriate quality.

Infrastructure of the drinking water supply is made up of quite an organized system of the city water pipelines (public water supply) the length of which amounts to 137 thousand kilometers. It is essentially lower in its organization than the system

of the agricultural water supply represented by a group of water pipelines, local intakes of the underground waters mainly of the hole type and a numerous traditional shaft wells.

The sources for the public water pipelines are 75 per cent of the surface waters, those for the agricultural water supply are mainly the underground waters.

It has happened so that, like in many republics of the former Union, in Ukraine practically all the functioning industrial and drinking water supply systems based on use of the surface sources were constructed with taking into consideration the processing scheme which provided purification of the water from the sources not higher in Quality than that of the second class, that is from those with a moderate level of contamination. The researches carried out during the last years testify that the quality of the water in the rivers of Ukraine is related mainly to from the fourth to the sixth (rarely to the third) classes. And the trend of the surface waters quality to worsen is progressing. In such conditions the modern technologies are already incapable to provide the level of purification (preparation) of water meeting the requirements of the "Drinking Water" Standard. Furthermore, some types of the surface water technological processing (chlorification), for its excessive organic contamination, result in formation of the toxic new formations.

In such conditions, considering the modern economic and ecological situations, the most real trend, concerning improvement of the drinking water supply, is intensification of use of the underground waters from a relatively deeply lying water carrying horizons.

The total operation stores of the underground waters amount to 57.2 million m^3/day & night. Their modern use is 22 per cent. Out of 896 explored areas of the underground waters there are 533 that are developed and run into operation having the total water intake of 5.55 million m^3/day & night while the approved stores amount to 15.65 million m^3/day & night.

Therefore, in Ukraine there are the objective preconditions for optimization of use of the underground waters aiming at improvement of the drinking water supply to the significant part of the urban population.

As for the rural population is concerned, here still exist various problems of supply with the drinking water of good quality.

This is, first, a result of actions of different causes, and primarily that of the effects of the economic activities, that the ground waters widely caught by the shaft wells are everywhere contaminated (mainly with the compounds of the organogenic origin) to the level of their unfitness for the drinking purposes.

For a group rural water pipelines basing Mainly on the surface sources there are the same problems that for the public pipelines. Moreover, supply of water along the multikilometer water pipelines accounts for a high self-cost of 1 m^3 of the drinking water obtained by the customers.

In a number of the Ukrainian regions the underground waters are characterized by an unfavorable natural hydra-chemical background (mainly by an increased mineralization).

There are also other problematic issues concerning improvement of the water supply to the rural inhabitants.

So, in the author's opinion, the mainest trend in development of the agricultural water supply in Ukraine there should be creation of local water piping systems based on the underground waters of the main water carrying horizons reliably protected from the surface contamination.

An important task is also wide use of the compact systems for water purification based on the membrane technology. Unfortunately, such kind of systems is not produced in Ukraine.

A reasonable in this connection water distribution action is a further development of the artificial additional enrichment of the underground waters resources by means of the engineering methods.

PROGNOSIS OF CONTAMINANTS SPREADING IN INTERRELATED GROUND AND SURFACE WATERS

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Studying of the ground and surface water interaction is getting more acute with the growth of the anthropogenic water load. Waste water discharge, intensive use of chemical fertilizes and pesticides in agriculture lead to the degraded surface and ground waters. Most alarming is water contamination caused by the ground burial of the toxic waste. In the paper are considered the cases of frontal and longitudinal-interaction with the help of mathematical modeling depending on the character of the interaction. It can be assumed that the mutual influence happens at the boundary of the mass water contact and mathematically is expressed by corresponding boundary conditions. The problem of dissolved admixtures transport with ground water flowing to the water reservoir solves the soil salinity problem and then the water salinity problem. In this case the concentration in ground waters should enter the right-hand side of the contaminant transport equation in the water reservoir, i.e. it is and output value for ground water problem and input value for the salt transport problem in the surface flow. When the

flow is directed from the reservoir to the ground, first of all is solved the problem of water salinity in reservoir and after it the problem of groundwater salinity. The contaminant concentration acts as a boundary condition of the ground water boundary problem, i.e. it is an output value for surface flow problem and it is as input value for the ground flow problem. The main factor preventing from the elaboration of the joint decision is a great time difference of the processes which take part in the surface and ground water flows - it varies from seconds to hours in the surface flow and from days to months in the ground flow. To overcome this difficulty a corresponding interaction algorithm is worked out. When solving a salt problem, the processes of salt transport should be modeled with the help of the information about the filtration process. Interaction of seawater and ground water in the adjacent areas is one of the main elements of the surface and ground water interaction in coastal areas. On the basis of the theory of the mass transport in porous media is solved the problem of the sea water intrusion into the inhomogeneous and layered aquifers with natural and artificial inhomogeneity with regard to the density dependence, liquid viscidity and concentration of the dissolved salts. The study of the intrusion conformity is needed for the effective use of coastal aquifers for the purpose of water supply depending on the alteration of the water balance elements such as precipitation, recharge or discharge of fresh and salt water from and to the aquifer.

MASSFLOWS OF SUBSURFACE HYDROSPHERE AND THEM DESTABILIZATION UNDER THE INFLUENCE OF ANTHROPOGENIC ACTIVITIES

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Massflows of subsurface waters in tops Earthly Crust is producing constantly from the moment of division of substance in atmosphere, hydrosphere and lithosphere. As a result of there activities on the Earth quasistationary or changing evolutionary flows of subsurface in which the most important place is occupied by subsurface waters and chemical elements soluted in them.

Appearance on the Earth of powerful productive force - human economic (mining, industrial, meliorative and agricultural and ets.) and military activities lead to the essential changes in directions and masses of natural flows of subsurface waters and chemical elements. As a result, this leads to the change in direction and velocity of subsurface distribution and connected with it modern exogenic geological process. On the Earth as a whole these changes still seemed insignificant. Bat at the some time for many separate regions and areas they are of great importance, as, for example, territory of the large towns rigents of industrial enterprises, they have huge significance, resulting to destruction existing geoecosistems.

We now have to take into account distant consequences of geoenviromental destabilization. Therefore, the studing massflows of subsurface waters and chemical elements soluted in them under anthropogenic activity is executeal on all levels of Hydrosphere, beginning global. As a continental level is considered the territory of Russia, regional - Volga river basin, local - basins of Moscow river and its tributaries and territory of Moscow-city .

Is shown, that significance specific massflows of chemical elements in subsurface waters of high levels Hydrosphere and in ecology pure regions vary in comparison a little, within the limits of 2 times in that or other side. At the same time at local levels depending on features anthropogenic load, significance specific massflows of chemical elements, specific for each natural model, can differ from background on the order and more.

STRATEGY OF WATER BODIES PROTECTION FROM GROUND WATER CONTAMINATION BY OIL PRODUCTS ABSTRACT

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The contamination by oil products of geoenvironment as a whole and ground water in particular is one of the most dangerous contamination. This is due to large evolution of this type of contamination as well as to high inertia of geoenvironmental contamination by oil products is "invisible" and often

appears when it attained the disaster point.Based on experience of investigations in different countries of CIS (Russia, Ukraine, Kazakhstan, Uzbekistan) one can see that practically all the objects connected with oil and oil products are the sources of geoenvironmental contamination. The similar results were obtained in other countries although the extent of contamination is essentially less there. The worldwide experience confirms that the investigations results related to remediation of geoenvironment contaminated by oil products are not in keeping with important undertaken efforts and financial investments. So, one may refer to the investigations conducted in USA at the sites "Superfund". In spite of multimilliardth expenses, the proposed goal of complete environmental remediation have not been realized. Incorrect formulated and, in general case unreal purposes are the reason of this fact Taking into account noncommensurable financial resources and extant of contamination in Russia and USA the choice of right strategy based on formulation of real goals is the most actual. According to the accumulated world experience of geoenvironmental restoration at some hundreds of sites one can affirm that remediate actions should not be brought to contaminants content in water and in soil to the point of maximum permissible concentration, but primarily the protection of water bodies(water intakes surface basins, and rivers) against environmental contamination must be performed. In doing so, the maximum permissible concentration should not be exceeded the safe level for population and environment. So, the policy concerning the remediation of geoenvironment contaminated by hydrocarbons would be focused at this direction. The above considerations suggest the following stages of study, assessment and contamination by oil products taking into account the widespreading of such phenomenon as well as financial ways of remediation:

1. Geoenvironmental certification of enterprises and works organization by extraction, transportation, refining, storage and distribution of oil products, and on this basis, selection of sites of prime importance.

2. Studying the extent and intensity of contamination at selected sites and revealing the environmental hazard. Identification of sites for ground water protection against contamination.

3. Conducting the specific researches to obtain initial data for design of protective measures. This stage is especially important because, as experience shows, every contamination site is unique and the theory used at the present time does not like into account a number of essential components of two-phase flow in inconfined aquifers.

4. Development of measures concerning localisation and, if it is necessary, partial elimination of contamination and primarily, mobile oil products as the most dangerous type of contamination

5. Feasibility of elaborated actions by stages.

6. Monitoring of geoenvironmental contamination for prompt actions in case of hazardous contamination and correction of undertaking measures. The proposed strategy is in logical accord with a conception of "Supervision of ground water contamination". The examples of ground water contamination by oil products at a range of sites in Russia, the advanced experience of study and assessment, and elaborated on this base the remedial systems for water sites protection from contamination by oil products are considered in the paper.

EFFECTS OF FEN SOIL REWETTING ON THE QUALITY OF SURFASE WATER USED FOR GROUNDWATER RECHARGE

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The so called Droemling is the most important fen area in the new federal German state of Saxony-Anhalt. It occupies an area of nearly 25,000 hectare. This area is part of the catchment of the Ohre creek (a tributary of the Elbe river). Around 12 - 24 million m^3 water of this creek are used every year for ground water recharge by the Colbitz waterworks responsible for the drinking water supply of Magdeburg region with its 500,000 inhabitants. Because of this matter of fact the monitoring of water quality parameters like the content of nutrients and humic substances is very important.

Main parts of the Droeming fen area belongs to a nature reserve. Some former intensively cultivated sites were rewetted to reduce fen soil degradation and to initiate a new fen growing. Other parts of the Droeming are currently extensively cultivated (pasture land).

Because of lacking experience in the field of fen soil rewetting, in situ experiments were carried out to primarily investigate the environmental effects of charges in the farming system of fen soils since October 1992.

The research programme was implemented on 12 agricultural sites with different farming systems (rewetted fen sites, extensively farmed pastures and change from intensively used arable land into extensively farmed pastures). Ground water observation pipes were installed on the sites of measurement. Soil samples were taken at 3 different depth (0 -90 cm) accordingto the stratification of the soil layers. In addition, samples from the ground water

(boreholes) and surface water (neighboring ditches and ponds) were recovered. All water and soil samples were futher measured for their Dissolved Organic Carbon (DOC) concentration. The inorganic nitrogen content of the soil of intensively farmed sites investigated was considerably higher than that of extensively used pastures and of fen soils in nature reserve. The decisive parameter for the inorganic nitrogen content of the fen soils examined was the ground water level. High ground water levels contribute to the conservation of fen soil and protection of inland waters. Hence, the rewetting is able to guarantee the preservation of still remaining fen soils. An increased nitrogen leaching by the water pathway wasn"t observed. On the other hand, a tendency towards increased phosphorus and DOC concentrations appeared, which must be quantified in futher investigations.

SECTION II
WATER SUPPLY

ECWATECH

TRACK MEMBRANES AND PURE WATER

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Track membranes are produced by treatment of polymeric films with the thickness 10-20 mkm exposed to high energy krypton ions punching the film through. At the sites (points) of moving some ions through, the channels are generated from the destructed material (tracks) which is different from the non-affected material in its physico-chemical properties. At the subsequent etching of the film irradiated by heavy ions in an alkali solution, strictly alike holes of cylindrical shape are formed at the sites of the tracks. The diameter of the holes can be varied in the range of 0,05-3 mkm depending on an etching conditions.

The heavy ion accelerator U-400 of FLNR, JINR, producing up to 10^{12} ion/sec, is used for the mass production of the track membranes. It allow to produce track membranes with a pore density in the range of 10^5-10^9 pore/cm^2. The porosity of such membranes is 10-15%.

The main property of the track membranes differing from the other types of the membranes is their high selectivity (all single pores have the same diameter with the deviation not more than 5%). So depending on the functional purposes (filtrating of mechanical impurities, bacterium or virus suspensions etc.) a corresponding nominal value of the track membrane to be optimal for a definite micro-filtering process, can be chosen.

One of the practical applications of the track membrane is its use for drinking water purification in everyday life. For this purpose the track membranes with pore size 0,4 mkm were used.

Simferopol scientific industrial company "SIMPEX" in collaboration with the company "NEROX FILTER OY" (Finland) have designed simple water purification devices "Crimean dew-drop"and "NEROX".

The filters operate at the expense of the natural gravitatioal differential in pressure. The using of operating conditions of the track membrane with the natural 0,1 atm pressure allowed to use it as a multitime filtering element. Working in such operating conditions, the track membranes seemed to tend not to be plugged, and all the filtrated mud (sludge) remains on the surface of the membrane and is rinsed with water. The productivity of the filter is up to 25 liters per day. The resource amounts up to 2500 liters in running water with periodic rinsing as the productivity decreases.

The results of testing the filters by the authorized experts show their good characteristics as to purification quality (cholera virus and plague virus, intestinal bacillus, pesticides - 100% purification, heavy metals - up to 90% purification) and sanitary reliability.

The designed devices have a number of essential advantagies over the available water purification devices:

- the filter does not require cartridges changing;
- the filter provides a granted filtrating quality because of using strictly calibrated pores;
- the filter operation requires neither electric power supply not running water pipelines pressure;
- the filter prductivity can be increased by provided butting end-to-end the filtering elements;
- a complete picture of the purification results;
- available indirect system to signal a contamination of the filtering element (decrease of the filter productivity);
- the filtering element is pure from the ecological viewpoint, i.e. no sorbents or other chemical elements are contained in it;
- there is no permanent indirect contact of the filtering element and purged water.

The application of the described technology for water purification seems to be promising. Work is in progress on improving the design of the devices and the membrane as it is.

DESALINATION IN SAUDI ARABIA: MEETING THE INCREASING WATER DEMAND

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The Kingdom of Saudi Arabia with a surface area of 2.25 million square kilometers (MKm^2) and a population of $16x10^6$ inhabitants has no lakes nor flowing river. Drinking water is supplied from two major sources, ground and desalinated sea water. The domestic and industrial water demand rose from 1.38 M m^3/d in 1980 to over 4.66 M m^3/d in 1990 of which 47% is supplied by desalinated sea water. The remaining 53% is supplied mostly by groundwater, of which 82% is treated with reverse osmosis (RO) being the most widely used membrane process for its desalination. By the end

of 1992 there were a total of 573 RO plants treating ground water with capacities greater than or equal to 100 m^3/d.

Saudi Arabia is considered the world leading country in the field of water desalination. By 1983, the total production of all desalting plants in Saudi Arabia was 2.5 M m^3/d and in 1992 reached 3.8 M m^3/d (42.4 % of total world capacity). There are major desalination plants located on the Western (Red Sea) and Eastern (Arabian Gulf) coasts. Those plants supply water to about 16 cities and towns with a daily production capacity of 1.85 M m^3. Other plants under construction or future consideration will increase the daily production capacity by 2.0 M m^3

This paper intends to address the issue of drinking water supply and demand in Saudi Arabia. Emphasis will be placed on desalination as an alternative in meeting the increasing demand.

WASTELESS TECHNOLOGY OF NATURAL WATER TREATMENT

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Up to 80% of water, consumed by communal and potable water supply of Azerbaijan Republic is treated from natural surface waters intake, the muddy of which is not constant and fluctuates during the year from 50 mg/dm^3 till 50000 mg/dm^3. That is why, owing to technological processes of water treatment, accumulates a great amount of slag's, that are either assembled in slag-accumulators, which occupy large ground squares or are thrown off into the basins. In both cases the ecological purity of the region if violated.

In this field we executed research works on revealing opportunity of treatment and application of such water precipitation's. We have received positive results. This work was held on the base of one of the largest waterworks of Republic - Kura river waterworks. The river waters treated in three stages: preliminary settlement, lightention and filtration. For water treatment sulfur-acid aluminum and polyacrilamyd are used.

At water treatment station about 612 thousand tons of precipitation's are formed during the year. They relate to the group of clays with low maintenance of water-soluble salts (0,126%) with prevalence of montmorrillonit, caolinit and hydrosluda in them. From the admixtures they include quartz, field spars, anhydrite, chlorate and others.

It is determined, that this precipitation's is good raw material for building materials manufacturing - USSR author's certificate № 622791. For instance the brick, manufactured from it, meet the requirements GOST 530-71, glazed plates - GOST 6141-76, agloporyt road-material - GOST 11991-76. Above-mentioned materials were at first received in laboratories, and then at semi-factories and factories.

So, we have elaborated complex scheme, that combines both the technology of highly-muddy waters treatment and usage of obtained precipitation's as a raw-material for production the mentioned building materials, thereby wasteless system of water treatment was created, which protects environment from soiling and landscape from destruction in consequence of natural career clay extraction.

THE CONTROL OF FREE RADICAL PROCESSES AS A METHOD TO INCREASE WATER QUALITY IN AQUACULTURE

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Nowadays the problems of the protection of environment and preservation of the ecological balance are especially urgent. This is associated with the increased anthropogenic impact on natural ecosystems, in particular, on fish stocks which have been reduced greatly. The pisciculture faces a problem to create favorable conditions for artificial reproduction of fishes with the aim of releasing a greater amount of youngsters, which can be done by improving the industrial methods. The most difficult is the problem to protect the aquaculture technologies against the pollution of waterbodies that have commercial fisheries.

The intensification of industrial breeding of sturgeons can be achieved by an increase in the viability of youngsters. Organic and mineral pollutants affect adversely, in the first place, the incubation of eggs. Thus, the development of effectively working systems of water purification and adequate indices of the control of environment

quality is necessary. The indices of free radical oxidation (FRO) are very effective reliably and promptly indicating the condition of water environment.

When zeolite filters were used to purify water entering the hatchery under study, the content of different toxic substances lowered by 85-92 %. The zeolite filter completely purified water of hexachlorocyclohexane, detergents, ions of lead with their respective starting content 0.000" mg/l, 0.007-0.044 mg/l and 0.00/& mg/l. The content of mineral oil products and zinc dropped to the level of maximum admissible concentration or even below it. The self-purification ability of water has been confirmed by the indices of FRO, i.e. the intensity of induced and spontaneous chemiluminescence of Fe. After purification these indices exceeded, beyond any doubt, the corresponding control values: spontaneous chemiluminescence by 11-155 %, flash by 35-47 %, allow impulse by 14-33 % and tg by 50-203 %.

With the improved FRO processes in water positive biochemical c changes in the developing sturgeon eggs have been observed. These changes indicate that the lipid state has been improved, they manifest themselves in the reduction of the level of lizophosphatidilholine and nonesterificated fatty acids by 11-21 and 23-30 %, res., and in the increase of the phospholipid concentration by 8 %.

Moreover, while the concentration of docosohexanoic acid increases by 5-27 %, the concentration of w3 acids in phospholipids rises by 6-12 % and the ratio w3/w6 increases, too.

Thus, the FRO processes affect the physiological and biochemical condition of developing eggs and they can be invoked to evaluate the environment quality in the aquaculture. In order to control the free radical processes in water, various sorbents may be used , for example, the natural zeolites.

THE ROLE OF WATER IN CIVIL ENGINEERING

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The properties of water as a solvent for different substances and its role in hardening binders and concrete are very important. One of the main contradictions in the technology of producing concrete mixtures and mortars is the necessity to combine a comparatively large volume of water for the concrete transportation, compacting and finishing and its minimum proportion for the cement hydration. Various investigations have been held in order to improve the quality or concrete and products made of it. In this connection, attention should be concentrated on the method of electrochemical activation (EChA) of water solutions and the application of the latter in the structural material production. [1]

Water EChA by the PMR method made it possible to reveal the water microstructure transformation [2] conforming to the X-Tay analysis data, the surface tension value change and the information received in thermodynamic investigations. Most likely, the water structure transformation initiated by EChA is an integral cause, in the aggregate connected with three factors: hydrate (solvate) formation influencing the translational freedom degrees of bound water molecules with respect to their free state; atteration of the formed ions mobility in electrolytic solutions modelled by a suitable capacity of solutions to conduct electricity; an increasingly important "active part" of water in a solution (tap water is a solution as well) apparently connected with the hydrogen linkage system destruction. Hence a disordered structure of electrochemically activated solutions complies with highest reactivity and leads to the acceleration of the hydration and cement stone structuring processes. These findings are confirmed by the research data on the kinetics of setting the cement slurry with common water and water electrochemically activated by the PMR method. [3] So, when the mentioned method is used, the strength limit of samples in compression in increased by 40%, concrete becomes two times denser, water absorption decreases and the softening coefficient approaches one.

It has also been shown that when the relation between plastifying admixtures and the water electrotreatment regime is optimal, the plastification effect reaches a considerable value. The water quantity decreases by 35%, the concrete strength increase by over 50%. More over, due to the application of a plastifying and air entraining admixture PASht, the concrete mass decreases markedly, by about 20%. And this is undoubtedly a positive effect. Our investigations have shown that superplastifiers which are rather expensive and scarce, may be advantageously replaced by a mixture of cheap plastifiers dissolved in electrochemically activated water.

A large body of research made it possible to prove that there is an opportunity to control the strength of structural materials (bricks, clay products), the quicklime slaking processes, the preparation of core sands with various properties, imparted with the help of an ecologically safe EChA method.

A plant which allows for producing electrochemically activated solutions with the pre-set properties was designed and constructed. It fits naturally into the technological chain of producing mortars.

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LOCAL UNITS FOR ADDITIONAL TREATMENT OF TAP WATER TO SERVE GROUPS OF CONSUMERS

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Many water supply sources have pollutants of anthropogenic origin. In such cases, water treatment plants play a small barrier role, and tap water is marked by presence of chemical pollutants which are toxic and hazardous for people's health.

In connection with this, investigations on special water treatment methods were carried out in a number of Russian cities, and the results were used to develop local treatment units, designed for separate city area or blocks, for children's institutions, schools, hospitals, canteens, etc. Capacity of the unit varies from 0.5 to 10 m^3/hr depending on their destination.

At present, design and construction documentation for the units has been worked out, and preparatory work for their production and field testing is in progress. Later their industrial production will be started.

The equipment of the units allows to use different treatment methods: ozonation and mixing of ozone-and-air mixture with water in a contact column, filtration through rapid filters with clinoptilolite, or granular activated carbon or other media, disinfection. filter units will be charged with modern most effective materials specially developed for these units.

Every unit is fully automated. The equipment, pipelines and fittings are made out of non-corrosive materials.

Purified effluent water will be used for drinking purposes only, as against water delivered from treatment plants, which is also used for industrial needs and household activities of man (toilet flushing, bath taking, washing, etc.).

Water effluent from the treatment units will by all parameters meet the State Standards (GOST) "Drinking Water", including the new version of the Standards. It will be hygienically and bacteriologically safe for people's health.

Developed local treatment units will find use in those cities and regions of Russia, where tap water does not meet the requirements of the Standards by organic pollutants and chemical compounds.

Their use can be considered as a temporary measure, till urban treatment plants are reconstructed and their operation is normalized, which many take quite a long time to achieve.

LABORATORY INVESTIGATIONS IN THE FIELD OF WATER SUPPLY AND WASTE WATER DISPOSAL CARRIED OUT IN THE CONDITIONS OF A PRIVATE ECONOMY

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1. The settlement of the drinking water supply problems is based on legal acts and the principle of preliminary preparation. Water in pipelines, pure water and pipeline networks are checked, including water flow gauges, to provide a water composition which meets the hygienic standards. The current study of the pipeline is carried out in the whole territory of the city in accordance with the assigned plan and includes the traditional determination of iron, manganese, number of colonies and E.coli.

The above aspects influence on a permission for the operation of new and repaired pipelines which are irreproachable in bacterial sense. Laboratories carry

out also an evaluation and a change in overloaded ground water (old waste).

Customers are individual water management enterprises which are directly responsible for the production of drinking water or, correspondingly, water network sections which are responsible for the ideal conditions of the water network.

Apart from control functions, analyses for private persons and enterprises (private sources) are undertaken. These services are charged at common market prices.

2. The settlement of waste water disposal problems is based on legal acts and production requirements which control responsibility for the ideal treatment of waste water. Here, customers are also enterprises. The number and places of samples are controlled as well as the water composition subjected to study. Substances are established by agreement between leading engineers of enterprises and the laboratory. Besides, 2-day investigation of effluent is conducted for study of its quality.

Parameters are established by water management authorities. They also carry out settlement with enterprises for the executed laboratory investigations.

In future, analyses on order will be carried out for private persons and enterprises instead of providing evaluations.

The laboratory includes a section responsible for control of waste water composition, which uses the waste water cadets, visits enterprises and checks that no prohibited substances enter waste water. Here settlements for the laboratory investigations are made.

ADVANCES IN ANTISCALANTS AND DISPERSANTS TECHNOLOGY FOR REVERSE OSMOSIS

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In the past twenty years, reverse osmosis has progressed from a laboratory curiosity and lecturer's tool to a viable engineering unit operation for the separation of aqueous streams. In the past five years, the economic necessity to drive higher performance from each and every operation has forced operators to run their membrane plants on lower quality feed streams at higher and higher recovery. This can be devastating to the membrane. Fouling of the membrane effects both the quality and the quantity of the permeate produced. Cleaning the membranes requires the purchase, handling, storage and disposal of the cleaning chemicals, increased labor requirements, and the downtime of the membrane plant. Additionally, the cleaning is physically damaging to the membrane. Finally, any foulant remaining on the membrane becomes a nucleus for additional fouling.

The correct application of polymeric antiscalants and dispersants can reduce the formation of scale forming salts and decrease the accumulation of particulate foulants. Historically, polyphosphates such as tetra potassium pyrophosphate (TKPP), sodium hexametaphosphate (SHMP), and sodium tripolyphosphate (SIPP) have been used to reduce the possibility of calcium carbonate scale formation in other water treatment industries. Only SHMP became popular in the membrane separations field. The use of polyphosphates were largely discarded with the advent of synthetic polycarboxylates. These second generation antiscalants are used in many applications where the scale formation potential is relatively straightforward. In other applications (particularly those involving complex feedstreams or high recoveries), a third generation, multi-functional antiscalant based on copolymer technology is warranted. This paper will address the use of these high performance antiscalants to inhibit the information of scale forming salts, stabilize metal ions, and disperse particulate matter in RO applications.

THE APPLICATION OF HIGH PERFORMANCE POLYMERS IN WATER TREATMENT APPLICATIONS

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The build-up of deposits on heat exchanger reduces the efficiency of many industrial operations. These deposits may cause overheating and damage to the heat exchanger, unscheduled shutdown of the unit, and ultimately, failure of the system. As a result, frequent cleaning of the heat exchanger. The deposits typically encountered in industrial water systems include corrosion products (i.e.,Fe_2O_3, Fe_3O_4, CuO, etc.), mineral scales (i.e., $CaSO_4$, $CaCO_3$, $Ca_3(PO4)_2$, $BaSO_4$, etc.), particulate matter (i.e., clay, silt, etc.), and microbiological material. In boiler and cooling water systems, these deposits normally accumulate in low circulation areas and

may become immobilized during upset conditions resulting in deposit build-up on heat exchangers.

The successful operation of the industrial water system depends upon the use of chemicals added to water to control corrosion, scaling, deposit formation, and microbiological fouling. Over the years, water conservation measures and environmental restrictions have combined to make these problems more challenging to the industrial water treaters. Historically, many of the chemicals used in the industrial water systems were natural products. During the past ten years significant advances have been made in the field of polymer technology since the introduction of synthetic polyacrylates some forty years ago. Currently, there are a wide range of homopolymers, copolymers, and terpolymers available for use in industrial treatment applications. This paper explores the relative effectiveness of a full range of polymers from the basic homopolyacrylic acids to copolymers containing a variety of different functional groups. The influence of polymer molecular weight as it relates to polymer performance will also be addressed.

ABOUT THE INFLUANCE OF ORGANIC SUBSTANCES ONE DESOLINATION PROCESS OF NATURAL WATER AND ON REGENERATION OF ION-EXCHANGERS

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Presently the surfacal watermain is substantually polluded by organic substances of different origin. Those substances have various physical and chemical characteristics and, therefore, can be treated as basic ions and anions of weak and strong acids, as neutral compaunds and even can practically take part in ion-exchange processes.

Organic substances are absorbed during the desolination pro-cess by ion-exchangers, and afterwards are partially deabsorbed during regeneration, patially irreversibly. As the result of this irreversible absorbtion at the first stage lowers the exchange capacity of ionexchangers, particularly anions, and at the same time increases the water expenditure for purification; at the later stage arises the necessity of total replacement of ion-exchangers.

Consequantely, the role of preliminary rectification in schemes of chemical desolination besomes more significant from the point of view of more effective purification from organis substances. But even in cases of effective lowering of the level of organic substances during preliminary rectification, ion-exchangers are under the high pressure.

The scientists of the State Scientific Research Center of Russian Federation "NII VODGEO" observed the influance of organic substances on desolination processes of natural water and ion-exchanger regeneration. All above mentioned was observed on Power Plant-22 and Power Plant-5 "AO MOSENERGO".

Initial water on the above mentioned stations contains 40 mg of organic carbon and wide spectrum of organic substances.

Schemes of desolination process on those stations include preliminary rectification (processing with lime and coagulants) and two stages of desolination.

During all stages of desolination one can observe not only monotonous lowering of content of organic substances, but also up-risal at one of the stages.

This happens due to the more quicker work-off of organic sub-satnces in ion-exchangers than non-organic ones. The above is con-firmed by comparison of chlorins and permanganate oxydazability in diagram of regeneration of anionic filter of the first stage (VARION-AD). Therefore, one can make the conclusion that anion filters should be checked not only from the point of view of non-organic indexes, but also from the point of view of organic ones.

It is established, that during the rectification from the organic substances the main load falls on the period of processing with lime and coagulants. So, "VARION- AD" on the Power Plant-22 absorbs up to 450 gC/ m^3 permanganum oxydazability during the filter-cycle. During the period of self-regeneration the same filter ousts only 50% - 70% of the absorbed previously organic subsatnces. The rest part is irreversibly absorbed by anions.

The technology of successive regeneration of anion filters of the first stage by worked-out alkalescent solution of anion filter of the second stage polluded by organic substances is widely used on power plants. For all this one can observe the growth of the organic substances, irreversibly absorbed by the first stage ani-ons and lowering of the quantity of ousted non-organic ones.

Anion-exchanger (VARION-AD) has the biggets capability to absorb organic substances, which are found in worked out alkalescent solution of anion filter of the second stage. Anionexchanger AN-31 has the lower capability for the same process of absorbtion.

The diagram of non-organic and organic components of anion filters of the second stage which were received after regeneration enable to single out the organic content of workedout alkalescent solution and not to direct it to the filter of the first stage.

The regeneration process of the filter of the first stage by worked out alkalescent solution, which conteins minimum of organic substances made the above mentioned process of nonorganic components more effective and lowered the level of pollution of anion-exchanger by organic substances.

Let's illustrate this by figures. If during the traditional process of successive regeneration of anion-

exchange filters of the first and second stages, filter of the first stage outs approximately 800-1000 gC/m^3 of bi-chromic oxydazability, during the regeneration partially by worked out alkali is ousted 2000 - 2500gC/m^3.

All above mentioned helps us to value the influance of orga-nic substances on desolination process of water and regeneration of ion-exchanger.

ECOLOGICAL WATER-UTILIZATION FOR IRRIGATION AGRICULTURE AT THE SOUTH URALS

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The 25 years experience of the development of water utilization for irrigation agriculture at the South Urals has revealed that the greatest productivity of the irrigating areas has been achieved under the conditions approximated to the natural ecological conditions of irrigating landscape. It is necessary to remain the attributes of its water conditions for aeration zone, material balance with accumulation (or absence of deficiency) of calcium carbonate and humus? to stop accumulation of sodium compounds? radionuclides and heavy metals. Under conditions of irrigation all these characteristics are derived from the receipts of matter receiving with irrigating and subsolid waters.

Requiring irrigation standard is defined from the following equation:

$S=100aHK_1K_2K_3(B_0-B_1)$, where

S - requiring irrigation standard, m^3 per hectare;

a - soil mass by volume, g per cm^3;

H - depth of root-inhabited layer, m;

K_1 - coefficient, taking into account water waste in irrigation system together with irrigating outflow (for irrigation systems in Chelyabinsk area it may be accepted as 1,2);

K_2 - coefficient, taking into account the necessity of prevention the abundant supply of mineral saits in the process of root-inhabited layer feeding by subsolid waters (according to table 1);

Table 1. Coefficient quantity K_2

Cultivation	Mechanical structure of soil	Level of subsolid waters, m				
		1,0	1,5	2,0	2.5	3.0
with deep roots (maize, sunflower)	standard	0,24	0,66	0.77	0.89	1.00
	heavy	0,26	0.72	0.84	0.98	1.00
with standard roots, according to their depth (herb, potatoes)	standard	0,43	0.73	0.86	0.93	1.00
	heavy	0,47	0.80	0.95		1.00
with shot roots (vegetables)	standard	0,62	0.87	0.95	0.98	1.00
	heavy	0,68	0.95		0.99	1.00

K_3 - coefficient, taking into account the irrigating water quality. K_3=1,0 for I and II classes of quality (quite satisfactory, satisfactory); K_3=0,8 for III class (not enough satisfactory); K_4=0,6 for IV class (non satisfactory); the class of quality is marked according to "Water quality requests for irrigation in the South Urals area" (Antoshenkov Y.P., 1995);

B_0 - field (minimal) liquid capacity of calculating soil layer, % to dry soil weight;

B_1 - humidity before irrigation, % to dry soil weight.

Experience demonstrates that when non satisfactory quality of waters is used for irrigation, it is reasonable to refuse the usage in plant - growing association of red clover, lucerne, cabbage and maize which productivity is diminished greatly under such conditions.

The most effective regulation is possible for ecological state of eluvial Landscapes with soils of chernozem, grey eath and containing podzol lines with good natural draining by subsolid and superficial outflow.

The list of turning to account literature.

Antoshenkov Y.P. Geosystematic principles of water ecotechnologies.- Chelyabinsk, 1995, 169 p.

THE WORKING OUT OF EXPERT SYSTEM OF CHOOSING OF UNDERGROUND WATER METHOD

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The complex composition of underground water do not often allow to use simplified aeration method for cleaning underground water, which is often recommended by "Engineering standards and rules" This scientific-methodological problem how to substantiate the chosen method of cleaning water for caring out of testing removing iron from the water. It influence the efficiency, cost and reliability of the cleaning water. The computing expertise system can help much with specialist's knowledge in definite field of science and is able to give recommendations for making decision at the level of these specialists.

Whether expert system is possible, justified and appropriated for solving your problem about choosing of the cleaning of the underground water definite method we liated the following necessary requirements:

- your task requires some intellectual habits;
- the expert can describe their methods of work;
- as for making decision all the experts are unanimous;
- the task is not very difficult and is clear understandable;
- the task will be solved at the highest level;
- the task requires heuristic knowledge;
- the task is of practical interest.

Thus, we can come to conclusion, that springing up of expert system in the field of the cleaning of underground water is allowed to improve the quality of making project decisions with less labour expenditures.

It must be formulated a common task for each case. It the necessary to create a laboratorial prototype of expert system of productional kind, which will a large base of knowledge. The system must choose the best method of cleaning water among the known methods, operating with quantity of facts and rules, which keep in the base of knowledge. It's evident, that there will be keeping a limited number of methods of cleaning water in the base of knowledge, but there will be a considerable volume of entering information. It's advisable for a short period of time to consider only one decision. Then it must collect and choose all the facts, which can confirm the choosen decision or disprove it. Such kind of strategy must use the mechanism of withdrawal with back chain of arguments. This mechanism is completely suitable for definite task. The program code, using for structure of the back chain of arguments is made according to the principles "from the top to the bottom", and "from the goal". It's connected with a arm, which define the structure of the rule of the highest level.

The cover of expert system was realized with the help of "Turbo Prolog" program language, that has the following features:

- the back chain of reasonings;
- slipshod logic;
- the "how" and "why" explanations;
- the describing lines are the objects of reasonings;
- relative word combinations are allowed to be on premises of the rules.

GEOTECHNOLOGICAL DISTRICTATION AND CRITERIONS OF CHOICE OF METHODS PURIFICATION OF UNDERGROUND WATERS ON MIDDLEAMUR ARTESIAN BASIN

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Use of underground waters on Middleamur artesian basin for the drinking and technical water-supply complicate increased content of a iron and manganese in aquifer.

The successful experience on purification underground waters from Fe and Mn in situ, conducted on a number water-supply of a region have since 1990 allowed us to allocate main hydrogeological and hydrogeochemical parameters, enabling a degree of efficiency of application of this way of purification.

The principles of geotechnological districtation developed for the Middleamur artesian basin, can be used for drawing up of similar maps on other regions.

NATIONAL STANDARD PATTERNS - THE BASE OF RELIABLE WATER MONITORING

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The Law of Russian Federation "The Measurements Unity Providing" stipulates spheres that are covered by National Metrology Control and Inspection which imply obligatory employment of National Standard Patterns (NSP) as metrology means of composition and properties measurement. One of such spheres where NSP employment is obligatory is quality indexes control of natural, potable and sewage water.

Some years ago Water Research and Control Centre (WRCC) started the work on development and mass production mastering of composition NSP for toxic organic and inorganic ingredients which content in water is regulated by national and international normative documents now in force.

By the present moment WRCC has developed and mastered mass production of wide range nomenclature of composition NSP for providing metrology means of water composition measurement. This nomenclature can be divided into several groups.

First group includes set of inorganic substances water solutions (anions and cations) composition NSP of 32 denominations, each of them includes several NSP with different concentrations of component tested. Relative error of these NSP set testing does not exceed 1,0 %.

Second group includes pure organic substances NSP of seven denominations. Relative error of principal substance content testing is less than 0,1 %.

Developed and produced in WRCC NSP are radically different from known national analogues by the fact that absolute methods of analysis are developed and used for their testing. These methods are based on fundamental physical constants, reference values of physical and physico-chemical properties of substances, materials and their solutions. Testing methods that are used in WRCC does not require any other NSP for their carrying out and are materialized in working standards and standard measurement means, duly tested in metrology organisations of Gosstandard of Russian Federation.

For example, for the purpose of testing composition NSP of heavy metals ions water solutions, Working Standard for molar concentration unit of electrically active in water solutions substances "Kulon" 154-1-94 is employed. This standard is based on using fundamental electrochemical constant.

Metrological testing of pure organic substances composition NSP is carried out in WRCC on Basic Standard Installation of organic substances molar fraction unit measurement "Kriom", which employs the absolute cryomeasurement testing method based on the using of cryoscopic constants of substances.

We also can list the following other advantages of WRCC NSP in comparison with their known analogues:

- For NSP the content of admixtures, controllable by modern analytical methods tools, is standardized;
- Whereas in sets of NSP a number of various concentrations is available, it makes easier to work out calibration curves and minimizes the errors while preparing calibration and control solutions.

NSP developed and produced in WRCC are intended for calibration and providing metrology means of measurement for various kinds of water composition testers, based on modern analysis methods (photocolorimetry, photometry, liquid and atomic-absorption spectrophotometry, ionometry, liquid and gas chromatography, polarography, voltammetry, spectrometry of inductor-confined plasma, X-ray fluorescence analysis); as well as for accuracy indexes control of existing techniques of measurements fulfilling (TMF) of water and water environments composition; for metrology testing of relative TMF; for approving (authorization) of analytical laboratories (centres).

Instructions for NSP application are attached to certificates, being the integral part of NSP sets.

ГИГИЕНИЧЕСКАЯ ОЦЕНКА ЭЛЕКТРОИМПУЛЬСНОЙ ТЕХНОЛОГИИ КОНДИЦИОНИРОВАНИЯ КАЧЕСТВА ПИТЬЕВОЙ ВОДЫ

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Многоаспектность проблемы обеспечения населения доброкачественной питьевой водой определяет актуальность научных разработок по совершенствованию технологий очитски и исследований по их гигиенической оценке.

На протяжении ряда лет нами проводились комплексные исследования по гигиенической

оценке новой технологии очистки питьевой воды с использованием низковольтных импульсных электрических разрядов (ИЭР).

В задачу исследований входило изучение эффективности очистки воды от загрязнителей различной природы, оценка безопасности и безвредности водопользования населения при употреблении воды, обработанной ИЭР.

При изучении гигиенической эффективности способа в качестве приоритетного было выбрано бактериальное и вирусное загрязнение (широкий спектр патогенных и условно-патогенных штаммов тест-микроорганизмов, энтеровирусы и полиовирусы, бактериофаги T_1 и MS_2. Оценивали также физико-химические и органолептические показатели обработанной ИЭР воды некоторых распространенных антропогенных органических загрязнителей (ТГМ, фенолы, ПАВ, бенз(а)пирен).

В предназначенной для обработки ИЭР водопроводной и речной воде искуственно создавали заведомо аггравированные условия: концентрация тест-микроорганизмов 10^6 - 10^9 мт/л, вирусов 10^5 - 10^6 БОЕ/ мл, бактериофагов 10^4 - 10^5 БОЕ/мл. Содержание органических загрязнителей в исходной воде моделировали на уровне 2 ПДК.

В хроническом 6-месячном эксперименте по оценке безвредности воды, обработанной низковольтными ИЭР, биологической моделью служили белые крысы-самцы линии Вистар. При выборе тестов в процессе проведения токсикологического эксперимента исходили из данных литературы о биологическом действии основных химических инградиентов, образующихся при обработке воды ИЭР, а также учитывали информативность ряда интегральных неспецифических методов.

Анализ результатов комплексных санитарно-химических, микробиологических и вирусологических исследований позволяет сделать заключение, что низковольтные ИЭР (2,6 - 3,0 кВ) с суммарной плотностью энергии 6,0 - 12,0 Дж/мл, являются эффективным способом кондиционирования воды, а качество последней соответствует после ИЭР-обработки требованиям предъявляемым санитарными нормами для воды питьевого качества.

Вода, обработанная низковольтными ИЭР (3,0 кВ; 6,0 Дж/мл), не обладает выраженными биологическими (общетоксическими) свойствами, что подтверждает результаты физиологических, гематологических, биохимических и морфологических исследований.

Результаты наших исследований позволяют рекомендовать низковольтные ИЭР как перспективный способ кондиционирования воды питьевого качества.

ESTIMATING THE MUTAGENIC ACTIVITY OF DRINKING WATER CONDITIONED WITH THE USE OF ELECTROIMPULSE TECHNIQUE

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To exorcise an affective control on the amount of mutagens and cancerogens in drinking water mutagenic activity (MA) of it is widely used at present. MA is an integral evaluation of mutagenic activity of all chemical water pollutants by various biological test-objects as indicators. MA determination becomes especially important in studying new techniques in drinking water quality conditioning.

it should be noted that significant MA of drinking water is revealed i a number of cases when the quality of drinking water fully corresponds to standard hygienic requirements according to traditionally studied list of chemical indices.

We investigated MA of water conditioned with the use of new low-voltage electroimpulse technique. The latter gives the possibility for as long as two months.

A well-known Ames-test was used to determine MA. Initial mutagenic activity of drinking water and water conditioned by low-voltage (2,6-3,0 kW) electroimpulse technique in the regime of purification (preservation) was estimated.

Samples of conditioned water (160-200 l) were filtered through a tube with polymer sorbent "Separon SE". After samples taking sorbent was evacuated and extracted by acetone. Acetone extract was evaporated and the sediment was diluted by dimetylsulfoxide. MA of the concentrate and its dilutions (1:5; 1:25) was made on the Salmonella typhimurium TA 100 and TA 98 strains with both complete and incomplete metabolic activation. Mutagenic effect was considered to be significant when exceeded an average number of revertant colonies in test variant (X_{on}) over control (X_k) by two or more times ($X_{on}/X_k>2$).

The findings of our experiments enabled us to come to a conclusion that drinking water purification by low-voltage electroimpulse technique with working voltage 2,6-3,0 kW and total energy intensity 6,0-12,0 J/ml do not in fact change MA of conditioned water as compared with the control. Preserved (U=3 kW; w=3,0 J/ml) and stored for two months drinking water was likewise devoid of mutagenic activity.

Thus, drinking water conditioned with the use of electroimpulse technique hasn't got any hygienically significant mutagenic activity.

THREE-STAGE MEMBRANE FINE FILTER

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The Scientific & Production Enterprise for Industrial Introduction "ИВ + К" and Research & Development Institute of Automated Means of Production and Control (NIIASPK) jointly developed and prepared for industrial production multistage water treatment systems providing high-quality ecologically pure water with output up to 500 l/hr. The first stage comprises filter elements made of inert fibber materials ensuring mechanical treatment and decontamination from colloid iron. The second stage comprises filter elements made of highly active carbon filter sorbent reducing contents of organic compounds, active chlorine, ammonia as well as dioxins - products of water chlorination process. The third stage is complete with membrane filter elements (three-dimensional cross-linked polymer membrane "Fora") with pore size not larger than 0,3 micron ensuring: - elimination of bacteria; - reduction of solved salts of iron, zinc, manganese etc.;- reduction of radioactive elements; Filter holders are made of corrosion resistant steel of 12X18H1OT (chrome/nickel/titanium) assortment with wall thickness 0,5 mm. Filter holder housings are manufactured using the following process: - pipes are fabricated on sheet-bending machine from steel sheets. - automatic argon are welding of longitudinal seams with further annealing.- rotary ring rolling using balls or rollers with cylindrical shell thinning and further annealing- Etching and electrochemical polishing. Thus, weld seams do not act as stress concentrators in case of internal pressure surge, corrosion formation and dead zone development inside filter housing are excluded.

PROSPECTS OF ACRILAMIDE-BASED POLYMERS INDUSTRIAL PRODUCTION DEVELOPMENT

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One of the water-soluble polymers widely used and attracting researchers' attention is poliacrylamide. Acrilamide polymers are gaining importance in resolving environmental problems - drinking and waste water treatment and more effective use of natural resources in the extractive industry - as an efficient flocculant to promote (intensify) thickening, clarification and filtration in coal, mining industries, hydrometallurgy, to expand the range of flotoreagents and chemicals for drilling operations.

Technology for powdered acrilamide polymers is based on polymerization of acrilamide in concentrated 20-40 % aqueous solutions in the presence of radical initiators under adiabatic conditions followed by grinding drying and crushing of the polymer product. The process of polymerization and cutting of rubber-like polymer is carried out in a specially designed plant. The production of powdered acrilamide polymers is a completely non-waste process. A wide range of high-molecular (MM - (1-10) $\times 10^6$) nonionogenic and anionoactive (hydrolysis degree from 0 to 50 mol.%) polymers has been developed.

The biotechnological technique developed for producing 20-50% acrilamide solutions features simple process design, cost-effectiveness and non-waste capabilities. The presence of impurities in aqueous acrilamide solutions produced by this technique depends only on purity of acrilonitrile and water used in the process. The absence of impurities in acrilamide solutions enables controlling the process of producing powdered acrilamide flocculants with specified properties governed by the molecular mass and chemical composition.

Studies on use of powdered flocculants to promote (intensify) processes in hydrometallurgy have resulted in development of H150 and A1510 grades which at a use rate of 5 to 100 g/ton of solids depending on the commercial slurry concentration intensify the process (reduce the time of settlement) and cut silver, tin, copper losses when thickening tin and copper concentrate sludge.

Flocculants find wide applications in recycled water supply. Their use allows a hundred and thousand - fold increase in a cooling rate of finely - dispersed particles and a reduction in suspended solids in recycled waste water to specification. The use of A1020, A930 and A1250 flocculants for flotation recycled water treatment in coal concentrating plants reduces water supply by thousand times as a result of clean recycled water produced.

The use of A1515 flocculant for clarification of power plant recycled water and water treatment in

chemical production processes increases process equipment operational lifetime as a result of a reduction in scale formation.

The proven optimal conditions of H150 and A155 flocculant usage for purification of drinking and natural water make it possible to reduce a use rate of known coagulants by 30-50% with improved drinking water quality in terms of color and aluminium-remaining content.

INVESTING TO PROTECT YOUR ASSETS

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Severn Trante Water, a utility company responsible for over 1.000 sewage treatment works and approximately 52.000 km of sewers serving eight million people in the UK, addresses the problem of now to maintain the serviceability of a diverse asset base. In doing so, it seeks to optimise a US$3.8bn five-year capital investment programme.

Traditional approaches to infrastructure, development and refurbishment rely heavily on the subjective judgement of local operators, municipal planners, and design engineers to assess asset performance, future demands, size and cost of extensions. Such judgement can very significantly between individuals, reflecting personal views and experience of risk, definition of acceptable plant, and cost parameters. Against this background, meaningful cross company comparisons are difficult and investment requests are promoted on an ad hoc basis hindering the optimisation of investment in all but the most obvious cases.

The problem has been successfully addressed by developing a suite of computer programs that ensure a consistent approach to all investment decisions. At the centre of the suite is an asset modeller that has all of Severn Trent's design rules encoded into its software. Thus provided with information on existing asset serviceability, future population and flow forecasts, existing plant performance and future standarts for discharge permits, the computer program can accurately define the size of future extensions and need for refurbishment of existing works across a 20-year planning horizon.

The final elements is a unit cost module which enables cost targets to be produced. To date, the software has been successfully used to define technical requirements and Maximum Allowable Outturn costs for over 2.000 separate schemes.

"THE URALS REGIONAL INTEGRATED WATER RESOURCES MANAGEMENT FOR THE EKATERINBURG WATER-SUPPLY SYSTEM" REGIONAL SUBCOMPONENT

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This report identifies the main objectives and plans for the implementation of the "The Urals Regional Integrated Water Resources Management for the Ekaterinburg Water-Supply System" Subcomponent (the Subcomponent), "Water Quality and Water Resource Management" Component (the Component) of the Environmental Management Project for the Russian Federation (the EMP). The EMP which is being financed out of the proceeds of the loan is a part of the Environmental Framework Program implemented by the Ministry for Environmental Protection and Natural Resources of the Russian Federation (MEPNR).

1. The subcomponent objectives

1.1. Major concerns among public health, environmental, and water supply agencies of Ekaterinburg include the following issues:

- threat to public health and the environment from source pollution and inadequate drinking water and wastewater treatment;
- inadequate source protection, drinking water production, and distribution system design and maintenance that results in a failure to consistently deliver adequate water service;

- lack of sufficient revenues and public support to maintain and improve the water supply infrastructure and operations;
- a demand for improved technological, legal, regulatory, and financial support for the Ekaterinburg water supply system;
- the growing negative impact of watershed condition on source water quality;
- monitoring system inadequate to the current demands of water quality and water resources operations management.

1.2. In connection with the above, the Subcomponent main objectives may be formulated as follows:

1.2.1. Elaborate legal, institutional, economic, and technical bases for integral water resources and water supply management in Ekaterinburg to:

1) reduce human health risks from unsafe drinking water supplies;
2) optimal water resources distribution and regulation in conformity with water economy situation and paying due attention to the environmental issues;
3) source and watershed protection against pollution;
4) feasible extension of use of alternative water sources and forms of drinking water supply;
5) legal and economic incentives for applying water-saving technologies and modern methods of industrial wastewater treatment;
6) distinct functional and competence hierarchy among different agencies involved in water management and control over water sources conditions, upgrade their financing procedures;
7) sustainable (cost-efficient) development of the regional water resources management systems and of the Ekaterinburg water supply.

1.2.2. Improve monitoring system for water bodies, water sources and water utilization (including institutional and financial procedures).

1.2.3. Upgrade professional level of personnel and decision makers in the field of water related economic management, upgrade information and technical support for decision-making.

1.2.4. Demonstrate the advantages of suggested schemes for integrated water management at a specially selected demonstration site.

1.2.5. Develop an integrated program for water resources management and the Ekaterinburg water supply and sewerage systems (including both short- and long-term investment plans).

1.2.6. Provide public awareness and involvement in the decision-making process on water supply system improvement.

2. Implementation plans

The Subcomponent will be carried out in three phases:

2.1. Phase I (preliminary preparation). Prior to mobilization of the FTAC the IT and the RC have planned and carried out the preparatory phase. On this stage an overall analysis of the current situation has been carried out, data gaps identified along with the priorities for obtaining the missing data. A detailed report has been prepared.

2.2. Phase II (Inception). During Phase II (Inception) the IT, the FTAC, and the RC (the Integrated Team) have jointly reviewed the issues and problems in the region, the region's priorities, the objectives of the EMP and this Subcomponent, and the resources available to carry out the work. They have also developed a detailed Work Plan and Schedule.

The work plan includes the following:

- recommendations on working out a General Approach achieving sustainable drinking water supply and potable water resources protection in Ekaterinburg;
- the input of FTAC, RC, IT and Stakeholders in each task mentioned in the Terms of Reference;
- the following aspects of water resources and the Ekaterinburg water supply system management upgrading: 1) technological; 2) institutional; 3) legal and regulatory; 4) financial; 5) investment priorities; 6) upgrading professional level of staff and decision-makers; 7) [project] results transfer and introduction; 8) public involvement;
- an order of action priorities, a logical sequence and scheduling of actions and the expected outputs;
- budget lines for actions to be carried out and distinguish financial resources as there are: the Subcomponent budget, Oblast and Municipality budgets, World Bank trust fund (e.g. Dutch Government);
- coordination and cooperation between this Subcomponent and the two other Subcomponents in the Ural Region: "Ecological Policy" and "Environmental Epidemiology".

The Work Plan has also been coordinated with the currently implemented (or planned) municipal and oblast programs for healthy environment and water supply system upgrading. Besides, it includes the recommendations from the Report of the EEC commission on the EEC Water Management Policy (COM(96)59).

The RC/FTAC team and the IT have prepared an Inception Report containing the data collected and recommendations developed, including the proposed Work Plan and Schedule. The Report has been considered and approved by the Subcomponent Management Committee, by the Municipality, the Oblast government, and the CMC.

2.3. Phase III (Implementation - approximately 3 years). The Integrated Team under the guidance of the SCPM has to carry out the tasks and activities identified in the Work Plan.

A SYSTEMS APPROACH TO RESOLVE THE PROBLEM OF THE DEVELOPMENT OF SELF-CONTAINED WATER SUPPLY AND WASTE WATER TREATMENT AND DISPOSAL PLANTS FOR DETACHED FAMILY HOUSES AND RESIDENTIAL COMMUNITIES

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An effective instrument to upgrade the quality of living is to promote the construction of individual (detached, semi-detached, terraced etc.) housing facilities. Independent experts predict the increment of the construction of such housing in Moscow and Moscow Province in 1996-1997 to some 10% of the total.

One of stumbling blocks in the way to boost the construction of family housing facilities is the absence of effective potable water supply and waste water disposal systems including waste water treatment plants for detached houses with a flushing mode of operation.

Irregular emission of waste water from detached houses in the context of a diffused and uncontrolled composition of the waste contributes to an enhanced biologically-induced pollution of soil, surface and ground water environments.

IPCW BIOCOMPACT is a company with a background of 30 years of practical work in the field of fine biological and chemical treatment of municipal and domestic waste water. The company has advanced a systems approach to resolve this pending problem to account for combined technical, investment, marketing, conversion and legal environments under the impacts of the privatisation programme underway in the water management sector of economy.

Costly and deficitory monetary resources and relatively lengthy paybacks in the municipal water management invited the development by IPCW BIOCOMPACT of a mortgage and leasing scheme to finance the construction and operation of water supply and waste water treatment and disposal without allocations from the Federal or municipal budgets.

Our estimates testify to the effect that investments into the development of the water management infrastructure for a 100 detached houses community pay back in a matter of 18 months. Rates of profit in excess of at least 20 % above the inflation index shall thereafter be arrived at from the financial productivity standards set for the operating company as a natural monopolist.

Market-based control instruments for the water management sector are being currently tested to operate water supply and waste water treatment and disposal system in the village of Tagan'kovo of the Odintsovski region in Moscow Province where 1995 saw the commissioning by IPCW BIOCOMPACT of a 25 cubic m per day capacity plant for a fine biological and chemical treatment of domestic sewage.

IPCW BIOCOMPACT has a vast variety of plants for an in situ fine treatment of waste water with a capacity range from 12.5 through 10,000.00 cu. m per day and employ a multistage method of nitrification-denitrification to upgrade the quality of water in compliance with the Guidelines of the Russian Federation for the protection of Surface Water by Waste Water i.e.:

Table.

BOD	3 ppm
Sssp	3 ppm
Ammonia Nitrogen (NH)	0.2-0.4 ppm
Nitrites (NO - N)	up to 0.02 ppm
Nitrates (NO -N)	up to 8-9 ppm
Total Nitrogen (PO - P)	0.25-1.5 ppm
Chlorides	up to 300 ppm
Sulphates	up to 100 ppm
Oil products	0.05 ppm
Surfactants	0.1 ppm
Coli-factor	0.001 at residual concentration of active Cl of 1.5 ppm
Diluted Oxygen (O)	6 ppm

The industrial assets of IPCW BIOCOMPACT are valued by the Foundation of inventions of Russian Federation at 5.6 million US dollars.

Implementation of the market-oriented mechanism of investing in and operating of the municipal water management invites spare and idling capacities of exmilitary businesses currently under the conversion plan to produce equipment for water treatment (like plants for the removal of iron and fluorine, filters, stop and control valves etc.), compact plants for a fine treatment of sewages, instrumentation and controls with an automated metering of payed consumed and disposed water resources.

The Administration of the Moscow Province is currently staging in Odintsovski region an experiment with a view to develop and verify a legal and regulatory basis and eventually start up a market-oriented mechanism of control in the water management sector.

IPCW BIOCOMPACT has been authorised within the frames of the above experiment to develop technical equipment, legal terms and guidelines for the accomplishment of works related to collecting and treatment of waste water from individual water users and to propagation of practical results obtained.

OZONE AS AN OXIDATION AGENT IN THE REPROCESSING OF DRINKING WATER

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Wedeco have developed ozone technology as a large scale implementable process with which unwanted materials can be removed from water using a mild, wet oxidation, leaving no residual dangerous substances. Examples of the reprocessing of contaminated water will be shown.

1. Introduction

Drinking water belongs to the most important nutritional means of humanity. People die without water.

Today, high demands are made upon the quality of our drinking water. The burden upon our bodies of water as well as upon their growing uses as drinking and potable water reservoirs forces us to implement improved reprocessing processes. Pure physical methods such as flocculation and adsorption no longer suffice. Additional processes must be used to remove all contaminates. Modern analysis methods are able to confirm the presence of materials in very small concentrations with very great accuracy. Ozone is therefore particularly considered for modern water reprocessing processes.

Ozone, a modification of oxygen is the oldest oxidant and has been in use for almost 100 years. Ozone counts as one of the strongest oxidants with high redox (oxidation reduction) potentials. Ozone can not be stored and must be manufactured for production where it is needed.

2. The manufacture of ozone.

The manufacture of ozone can principally occur as a result of all gases containing oxygen. Preferably air or oxygen are used as the applied gas world-wide. For the use of air an optimal gas reprocessing is needed, the melting point should be lower than - 60°C. Recently many customers prefer the use of oxygen as it allows much higher ozone concentrations in the gas than when air is used. With air one can achieve approximately 2-3% of the weight while oxygen achieves up to 16%.

3. Reprocessing of drinking water.

In the drinking water regulation dated 05 December 1990 (BGBL. 1.S. 2613) the permitted additional materials for the reprocessing of drinking water were newly defined. Chlorine and Chlorin dioxide are now only permitted in very low concentrations as a "long-term disinfectants". On the other hand, ozone is becoming more important as an oxidant and "basic disinfectant" for drinking water.

For the reprocessing of drinking water the following water sources are generally available:

- Ground water;
- Filtered river water;
- Surface water.

The ozone requirement differs according to the type of water. It varies between 0.5 and 6 g of ozone/m^3 of water. The example of several water works will illustrate the integration of the oxidation step using ozone.

Werner von Siemens built one of the first large ozone plants in 1910 at the water works of St. Petersburg. Approximately 48,000 m^3/ day of surface water from the Newa River were prepared there with ozone.

MODULAR SYSTEMS OF WATER PREPARATION

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Modular systems of water preparation are designed for:

- treatment of waste and return water from industrial premises up to the indices to conform

with the relevant standards for the disposal of water into natural reservoirs;

- supply of drinkable water to the population of towns and settlements by intake of the water from open reservoirs and artesian wells and its purification to the parameters to meet the requirements of drinkable water.

The plants are designed to operate long in the wide range of climatic conditions.

The engineered solutions provide the work of the plant both under living-assimilated conditions with power supply available and under autonomous extreme conditions.

The modular plants of non-reagent preparation of drinkable water enable to obtain toxic- and carcinogenic-free water the quality of which is many times superior to that of produced by traditional methods.

The plants consist of the following unit processes:

- filtering purification;
- electro-coagulation purification/treatment;
- desalination;
- ozone purification/treatment;
- control panel.

After water treatment from suspended particles, sized up to 5 mc by the hydrocyclone unit and pre-treatment filter, a small ozone charge is fed into the untreated water (column of primary ozonization). The pre-ozonization process is used for desinfection of the water as well as for removal of algae present in it, for preventing mucin formations, for oxidation of iron and manganese (if they are present in a form of ions), for ozonation of the part of organic substances present in the water.

The presence of ozone provides the optimal conditions and maximum efficiency of further coagulation of the colloid organic substances (electroliser). The insoluble compounds formed are retained by the filters with floating charge. In a follow-up process of the main ozonation (column of secondary ozonation) a required charge of ozone is added for desinfection and oxidation of the residual organic substances present in the water.

The second ozonation stage after storage tank is followed by desalination stage (which is particularly important for treatment of ground and artesian water) providing for removal from water the iron and salts responsible for hardness of water.

The adsorbed oxidized organic compounds in the fine filters are decomposed by the living microorganisms present in the carbon. At the final stage before feeding of the purified water to a water supply unit, UV water treatment can be carried out for providing additional desinfection.

The plants are mounted inside the loading container that consist of three partitioned compartments: power, processing and control.

The consumer's and practical innovation of the research effort is the combination of the following properties:

- versatility;
- possibility of creating model-based regional nature-preserving systems network;
- high degree of non-reagent treatment;
- low power consumption;
- easy maintenance.

CONCEPTION AND PROGRAMME MEASURES OF THE DEVELOPMENT OF THE STABLE, ECOLOGICALLY SAFE WATER SUPPLY TO THE POPULATION OF PRIMORSKY REGION

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The regional programme "Supply of the population of Primorsky Region with drinking water" is been working out in this region, the main aim of it is the guaranteed water supply of the region's population with good water from the centralized water-supply systems with the high degree of ecological safety.

This conception and all the programme measures are aimed firstly at mobilization of all existing possibilities of water-supply system with the maximum usage of its possibilities; also it is aimed at considerable reconstruction of existing water-supply systems; at the use of al modern technologies of water treatment, taking into consideration water quality in the sources and its changes in different non-standard situations; improving of the quality of surface and underground waters and other measures.

The existing practice of water supply in this region is based on the basin principle of territory's division into water management complexes; which allow to make prognosis of the water management system development, taking into account the potential of water bodies and the difference of their quality.

As a result of increasing of anthropogenic load on the water-catch area landscapes, the total level of chemical and bacteriological pollutions of the water sources has considerably changed. That is why the, special attention in this conception is paid to the water treatment.

The improving of the drinking water quality is supposed to be conducted by way of increasing of

the capacity of the existing water treatment constructions, using all modern technologies, by way of introducing the term "coefficient of the constructions capacity" for the group of similar in their quality water sources; by way of water treatment from the chlorine-organic substances and dioxins, and by way of correction of the water quality in such parameters as chlorine, calcium, magnesium.

We take into consideration the existing water sources, and among them those, prepared for extreme situations; the ways of decreasing of water loses; economic factors. We suggest the worked out norms of water-use, differentiated in accordance with the type of human settlements and the level of life.

THE USE AND DEVELOPMENT OF NETWORK MODELING FOR TRANSFORMING LARGE WATER COMPANY DISTRIBUTION MANAGEMENT

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Abstract:

Severn Trent Water (STW) has been actively involved in the development of network analysis techniques for the past 14 years. In the recent years, STW has been leading the field in the production and application of network models using the Stoner workstation Service (SWS) software developed by Stoner Associates Incorporated (SAI).

In 1990 STW embarked on an extensive model building programme to provide complete coverage of the Company's distribution systems by 1996. To date over 80 models have been built, covering over half of the Company's population. There are 18 model built studies currently in progress.

STW were the first water company in the UK to use SWS and their involvement with SAI from an early stage has enabled them to become leaders in the field of network analysis. The expertise and knowledge gained over the years by the Network Analysis Section (NAS) has enabled them to develop specific methodologies and procedures for model building which have been incorporated in a comprehensive NA manual and brief. Much of the model building in

STW is carried out by consultant engineering firms who produce models to the well developed standards set out in the brief. As well as the construction of models, detailed documentation is produced, including comprehensive Model User Guides. These facilitate use of models by expert and non-expert users throughout STW.

With the need to meet improved levels of service throughout the Company, STW recognised the need to develop a wider base of non-specialist users of network models, particularly in the day-to-day distribution management and operational environment. To achieve this, it was decided that every operating District should be provided with the tools necessary to use models. Each District and Planning office was provided with the appropriate computer equipment and to date over 130 people have been trained in the use of SWS. The NAS provides constant support to users through telephone contact and visits, and User Groups meet every quarter. These groups have helped to generate increased awareness of model use throughout the Company and provided a forum for the exchange of ideas and techniques.

Many of the traditional benefits which can be gained from using models have already been established in the area of investment planning, system design, source optimisation and emergency planning. With the wider use of SWS through the Company more benefits have been realiesd, including improved customer service, reduced interruptions through improved planning and reduced response times for information, which further benefits still to be realised

as models are used more widely. The high level of coverage and the quality of the model produced proved greatly beneficial in investigating and resolving the supply problems that occurred in the summer of 1994, enabling solutions to be implemented in a short timescale and with a high degree of confidence.

Over the last few years STW have made significant steps in the development of network modeling, including the introduction models that contain all mains, and the development of these model to stimulate water quality parameters. In the last two years STW have developed this area of modeling to the extent that benefits are now being seen with the use of'age of water' models, the modeling of nitrates and nitrate blending and in the simulation of chlorine decay in distribution systems.

DECISION-SUPPORT SYSTEM OF ASSESSMENT OF WATER SUPPLY LEVEL OF IRRIGATION SYSTEMS (AISS-WODA)

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The increased ecologization of public thought has demanded activization in solving problems of the use of scarce water resources. Automated technology of assessment of water supply level of irrigation systems and optimization of operation and maintenance measures aimed at improvement of the indices of irrigation water use is an important factor of upgrading the quality of decision-making on regional nature management.

The system is designated for the formation, storage and maintenance of data base in an operating state and provision of the users with resulting information on actual and design water supply into irrigation systems with regard for a region, oblast' and administrative-economic region, and output of recommendations on measures required for decision-making on the change of water supply level indices. The system is intended for water-management and nature-conservation organizations, engaged in measurement and assessment of water resources, and for the staff of hydrogeological and land-reclamation organizations, occupied with the assessment of engineering conditions of irrigation systems in compliance with requirements of maintenance of cadaster of hydrogeological and soil conditions of irrigated lands.

The following information is needed when assessing water supply level: the volume of water withdrawal in the head part of a main canal, as well as volumes of waste, return, drainage and groundwaters; efficiency of irrigation system; area under various agricultural crops; zonal values of irrigation requirement for a year of design probability by the deficit of water budget; actual atmospheric precipitation and during the year of design probability. Machine-oriented tables are developed for input of initial data.

Data bases on water-supply level of the systems are established by oblast's. The output information on the user's requests is presented at a terminal in the form of tables or printing with the use automatic digital printing device. The information contains the following data: initial data for assessment of water supply level of a system and obtained summary data for a rayon, oblast, region; results of the assessment of water supply level of a system; lists of systems with satisfactory and unsatisfactory levels and recommendations on the change of water use.

Software is designed with the use of algorithmic language FORTRAN and tested by computer of EC type. As desired by the customer, there can be implemented the development of program documentation, oriented at technical means of the user.

DRINKING WATER, MATERIALS, TECHNOLOGY AND WATERWORKS EQUIPMENT CERTIFICATION SYSTEM

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Drinking water, materials, technology and waterwork^s equipment certification system was entered into force in Russia by GOSSTANDART and GOSCOMSANEPIDNADZOR ordinance in April 1995. This system are based on the Russian Federation laws "On Consumer Rights Protection" and " On Production and Servis Certification". The certification system main goal is to promote of drinking water quality ensuring by means of water, materials and drinking water preparation equipment reliable estimation. The results of this tests must to correspond with the appropriate standards.

The certification object are the following: a) drinking water - water intended for human consumption, all water intended for the purpose of drinking and other domestic purpose, regardless of its origin and regardless whether made available by tap, in bottles or containers, and all water used n a food production; b) water cleaning facilities (individual, domestic, local etc.); c) chemical agents and materials used for drinking water supply (the matter for disinfection, coagulation, flocculation, absorbtion etc.); d) equipment for drinking water public supply (tubes, tanks, fittings, pumps etc.); e) water cleaning and transportation technological processes. The drinking water in bottles or containers and water cleaning facilities are the obligatory certification objects. The others presently may be certificated only according to producers request. In future the chemical agents and materials which cause the drinking water safety will also include in the list of obligatory certification objects. The certification objects hygienic estimation is the drinking water certification system obligatory special condi-

tion. The drinking water certification system organizational structure constitutes of the Central Organ and the number of regional certification organs and test analytical laboratories, locating in different areas of Russia. The Central Organ's duty and responsibility are the elaboration of methodical base for the certification system. This base has to include the number of normative documents (standards, sanitary regulations etc.) establishing the drinking water safety and quality requirements as well as the corresponding tests and analytical methods. The WHO Guidelines, Council Directive EEC and Standards ISO are also using to provide certification requirements according to modern regulations. Besides it is necessary to create some documents establishing certification and test procedures for each group of objects. Now it has already approved the rules for drinking water in bottles and containers, drinking water and technological system in centralized waterworks and water cleaning facilities. The other rules for chemical agents, materials and equipment will be developed in the nearest time by Central Organ. The application of drinking water certification system has shown its high effectiveness.

OXIDATION-RESISTANCE AND PERFORMANCE CHARACTERISTICS OF ION-EXCHANGE RESINS

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There have been a number of approaches over the years to develop ion exchange resins, particularly cation exchange resins, with oxidative stability: this has been achieved with limited success. The goal has not been merely to extend the economic lifetime. Quite a few applications exist, where the system is intrinsically severe, and resin endurance is limited, if not a prohibitive factor. The chemistry of oxidative degradation and previous attempts to solve the problem are reviewed. It is shown that the combination of good ion exchange performance and good stability is possible. The novel resins however have interesting selectivity differences when compared with conventional resins. ways to optimise ion exchange performance as the resin ages are discussed. Present results shows that a new class of resin overcomes some of the major problems and limitations of previous products.

A PROCESS SIMULATION ENVIRONMENT FOR NATURAL WATER TREATMENT

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A process simulati on environment named CONSTEC is developed for natural and waste water treatment flowsheets including reagent precipitation methods, together with or separately from basic manufacturing flowsheets. A process unit (in particular, a water treatment unit) is a basic element of the process simulation environment. The representation of any process unit includes:

- unit image;
- list of unit construction parameters;
- list of unit processing parameters;
- list of unit internal-state parameters;
- list of inlet and outlet streams;
- unit mathematical model;
- numerical values of the unit parameters and physico-chemical properties of substances needed for running the model.

At present, the first version of the process simulation environment is realized; it contains the following items:

1. The TEMPLATES item organizes input/output lists for:
   - physico-chemical properties of substances;
   - global flowsheet parameters;
   - parameters of substantial streams (flowrates, concentrations);
   - unit construction and processing parameters;
   - unit internal-state parameters calculated by unit models/
2. The IMAGES item creates unit images and sets locations and functional destinations of unit inlet and outlet points for controlling the flowsheet synthesis.
3. The MODELS item includes unit models in the form of EXE-modules. Unit models are to be written outside the system in any programming language.
4. The FLOWSHEET item serves for assembling and linking flowsheets. Process unit are chosen in the bank of unit images, arranged on the screen, and connected by streams.
5. The INPUT item graphically initializes parameters of the lists created by TEMPLATES and supports databanks for unit and streams.

6. The SIMULATION item calculates the synthesized flowsheet by running the unit models.

7. The OUTPUT item is destined for plotting, tabulating and verifying results of the simulation, highlighting messages of the models execution.

Different flowsheets can be synthesized by eliminating proper images from the unit images bank, arranging them on the screen, scaling, moving, adding, deleting, and linking them by inlet and outlet streams. A unit image should be supplemented with lists of its inlet and outlet streams, construction, processing and internal-state parameters, and finally its model. Unit images are created by a specific graphic processor and added to the unit images bank. Unit models are developed outside the system and their EXE-modules are included into the models bank. For running unit models, the following initial information (in the form of databanks) are to be used: physico-chemical properties of substances, unit construction and processing data, inlet and outlet streams data (water, reactants) and those internal flowsheet streams data which are needed to start the flowsheet simulation. Results of the simulation are accumulated in the databanks for internal states of units, internal streams and external outlet streams (treated water, sediment, releases, etc.). The simulation environment allows us to organize structures which would describe such features of natural, and especially, waste water streams as multiphase and multicomponent composition, distribution in particle sizes, sorption of impurities by solid particles.

WATER TREATMENT TO REMOVE CONTAMINATION OF ANTHROPOGENIC ORIGIN USING OZONATION AND ADSORPTION METHODS

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In many water supply sources, constantly or periodically, one may discovery specific organic contaminants such as aniline, formaldehyde, metanol, chloroform, carbon tetrachloride, dichlorethane, ethylene tetrachloride, polycyclic aromatic hydrocarbons, etc.

Among the above contaminants of raw ware, most often they detect phenols, and in some cases their concentration exceeds MAC 50 times or more.

In Russian territory, sanitary state of the rivers Volga, Oka, Kama, Tom, and most of the Ural and West Siberian ones is unsatisfactory. Ministry of Ecology data show that one of the most ecologically unfavorable region is the Kuznetsk Basin, in which air and water are polluted with wastes from a number of branches of industries.

All the variety of studies carried out at the treatment plants were aimed at intensification of plant operation and increase in treatment efficiency, mainly in bacteriological and organoleptic parameters (turbidity, colour, etc.). However, the existing technology could not ensure the necessary purification level by removing organic contaminants of anthropogenic origin.

Investigations of the Institute carried out at different water sources have show that one of the most real and effective treatment methods is combined use of ozonation and adsorption on activated carbon, as an addition to conventional technology.

The use of this method in treating highly contaminated water sources ensures substantial decrease in total concentration of organic substances and lowering toxic pollutants down to their MAC. Practically in all cases such technology allows to decrease chlorine dose by 30 to 40 per cent, coagulant doze by 25 to 30 per cent and obtain drinking water of required quality.

As present, based in investigations carried out in many Russian regions and cities by the Laboratory of Water Treatment Technology and Equipment of the Institute, recommendations for plant designs have been issued, some designs are being worked out, while in some cities preparations for practical implementation of ozonation are under way.

Using long-term studies, the Laboratory has also worked out and published "Methodic recommendations on the of ozonation and adsorption methods in water treatment to remove contaminants of natural and anthropogenic origin"(Moscow 1995). The recommendations provide general principles of these special water treatment methods. However, to avoid possible mistakes, effectiveness of using ozone and activated carbons, determination of design parameters and preparation of their operating mode must in every case be done by way of carring preliminary technological investigations.

AN ELECTROCHEMICAL TECHNOLOGY OF WATER TREATMENT IN ORE DRESSING SCHEME AND CLEANING OF NATURAL WATER FOR DRINKING TARGETS

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In IPKON RAN has applied to beneficiation processes an electrochemical method and conditioners for natural, mineralized mine water treatment have been developed (capacity from 0.1 to 50m3/h).

The electrochemical water conditioning method allows for control of physicochemical characteristic of water systems in the require direction without supplementary introduction of reagents.

This method implies treatment of water systems with direct current through submered electrodes.

It allows an extended range control of acid-base, oxidation-reduction and colloid-disperse properties of target products, the cleaning from suspended substances by 80-95% and from flotation reagents by 20-50%.

Electrochemical pretreatment technical water prevents the settling of salts on the pipe line and the boiler, decreases of corrosion velocity of metallic construction by 5-10 time.

The using of electrochemical technology for preparation of natural water excepts prechlorate and decreases colourity of water from 180-200 to 2-5 grades.

Electrochemical pretreatment water for grinding and flotation of different mineral complexes makes opportunity to increase recovery of valuable components by 2-19% and grade of concentrates by 0.5-2.5 %, increases selectivity and velocity of process by 1.3-1.8 time, decreases reagent consumption by 20-50%; velocity of clarification of water increases by 2-3 time; electric power expenditure changes from 0.25 to 1.5 kWh/m^3.

Electrochemical water treatment has been tested at pilot scale in preparation of natural water (town Mirniy) and in to flotation of diamond-containing, sulphide-scheelite, hematite, phosphorite, apatite-nephelite, bauxite ores and coal.

Electrochemical method of treatment water has been introduced at the Mirniy Mining and Dressing Complex, that enables to increase recovery of diamonds by 10- 15%.

HIGHLY EFFICIENT METHODS OF PRESSURE FILTRATION

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Uniform distribution of epure of filtration stream rates in filling thickness is considered to be one of the main conditions of high efficient of industrial clarifying, sorption and ion-exchange filters with fixes granular bed.

However, hydraulic and technological research carried out on standard industrial plants under the direction of Professor E. F. Kurgaev show practical noncompliance with the requirements. This fact demands special attention paid to the structure of existing filter apparatus.

The main reason is inadequacy of granular bed structure in the main and wall zones. More loose packing of granules in wall region in respect to the central one provokes the so-called "wall effect"which causes the formation of increased rates of treated water motion in wall zone.

As a result, by the end of filter cycle substandard water of the wall zone mixed other stream meeting the requirements of the technology, deteriorates the quality of the whole filtrate, leads to incomplete use of filling capacity and to premature stop of apparatus for regeneration, to washing water overrun, electroenergy, reagents, increase in regenerating water quality.

To use the main mass filling capacity to the full a new method of filtration and filter type were worked out. They allow to divide central and wall zone streams, the latter being led away outside of the apparatus thus increasing considerably technico-economical characteristics of filter plants operation.

Industrial test of modernized ion-exchange filters at one of the thermal power station filter plants of Arkhangelsk paper and pulp factory showed that the efficiency of actions proposed ranges from 10 to 35% of a pressure Na-cation exchange softener effective productivity increase depending on particular parameters and conditions of working process.

MAIN DIRECTIONS OF WATER AND SEWAGE SYSTEMS AUTOMATION

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Automation of Water and Sewage structures allow to increase their reliability and quality of work, reduce power expences by 10-15%, decrease number of operating staff by 5-10%.

New directions of automation have appeared now exept traditional ones (switching on and off pumps, filter washing, consumers payments, etc.). New types of systems performing full automation of pumping stations and water purification plants, ecologic water monitoring, etc. have been developing today.

We suggest the following automation structure of "Vodocanal" enterprises based on our long experience which includes:

1) automation management system of enterprise, consisting of automation working places connected in local computer network (supervisor, accounter, consumer department, chemical laboratory, technical department with electronic cards of water and sewage networks, etc.)

2) automation control system of water supply and sewage plants.

This system is a multilevel structure including:

- automation system of Central control station controlling water sources and water purification plants through local control stations. The automation system performs also direct management of pumping stations;
- automation control systems of water sources and sewage treatment works;
- automation system for central monitoring of pressures in water network;
- automation system for ecologic monitoring, i.e. operational control of natural drinking and waste waters composition;
- automation system for commercial accounting of drinking and wast waters flow at pumping stations and consumers.

Now there are modern technical and programme means (TV-complexes, sensors, programmes for data collection and processing) for realization of these systems.

Never the less as before there is deficiency of devices controlling qualitative water parameters, reliable apparatus for adjustment of operational efficiency of pumps. It is necessary to work out algorithms and programmes for optimal management of plants. Automation control systems of water supply and sewage are inculcated gradually depending on conditions of every city.

Except Moscow and St.-Petersburg automation problems have been successfully solving in Ryazan (on the base of Bulgarian TV-complex "MULTI-RO"), in Cherepovets, Revda, Podolsk, etc. (using domestic TV-complexes).

Modernization of before created automation systems of water supply is a typical problem (Ekaterinburg, Chelyabinsk, Orel etc.).

It is necessary to replace obsolete technical devices. In contemporary conditions it is very important to provide enterprises of "Vodocanal" with qualified consulting assistance including expert evaluation of proposals concerning delivery of new technical and programme means. It will help to solve automation problems more efficiently. Institute of Municipal Economy performs this kind of works and designs and inculcates automation control systems of water supply and sewage.

THE TECHNOLOGY OF DRINKING WATER PREPARATION BY SEA WATER THERMAL DEMINERALIZATION

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Natural demineralization water is indispensable condition of human inhait, all of living in the Earth. Sources of such, water are extremely irregular. At present conditions many sourses of water are mineralized contaminated by factory and domestic wastes. At first of all for production of drinking water from sea water it is necessary to demineralize it. The most reliable method of sea water demineralization is highest retaining ability. In the process of multiple-staged distillation macro- and micro- components are removed from the water in considerable degree and water can be conditioned to the level of drinking water of high quality. First the technology of preparation of drinking water from sea water by method of thermal demineralization was developed for sea ships with applying compositions of chemically clean components: sodium carbonate, calcium chloride, magnesium sulfate, sodium fluoride and other. Not high quality level of such water and deficit of chemically clean components limit the propagation of reagent technology.

In the connection of creation of atomic-power complexes in West Kazakhstan (town Aktau) there were carried out complex technological, physics-chemical and medical-hygienic researches that were completed by the development and mastering of combined technology of drinking water preparation from demineralization water. Sea water

is expose to termal demineralization, cooling, carbonization, filtration enrichment by calcium and sorption treatment by activated carbon, fluorination, stabilization (by alkali) and disinfection. In such a way demineralized drinking water of calcium carbonate group, physiologically of full value, well satisfied thirst, reliable in sufficient degree for its sanitary-hygienic and toxicological indexes was obtained from sea water.

Combined technology of demineralized drinking water preparation had been realized in many objects mainly in arid zones of Central Asia, Near East and North Africa. As example we note the station of drinking water preparation-35 and the station of drinking water preparation-40 in water supply system of Mangyshlak atomic-power station (town Aktau) in West Kazakhstan and the station of drinking water preparation in the object of heat station and demineralization complex "Aden" in South Yemen.

Project design of the plant for drinking water preparation-80 for Libya two-purposed atomic-power station and demineralization complex "Sirt", for drinking water preparation plant of various production with unit of distillation-demineralization equipment on low-grade heat of compressor stations, competitive suggestion of drinking water preparation plant-40 for the floating object of the type of atomic water supply object in Mediterranean Sea and drinking water-preparation plant-185 for water-supply system of the object in arid zone of united Arab Emirates had been developed.

AUTOMATED COMPLEX OF FINE FILTERING OF DRINKING WATER NIZHEGORODSKAYA REGIONAL PROGRAMME "CLEAN WATER TO CHILDREN"

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The supply of drinking water of guaranteed quality to cities, to towns and villages is next to impossible if a major problem remains unsolved that is water pollution in old water supply nets.

It is a burning question now with poor financing and time worn out water supply lines.

A solution that we consider most acceptable here is a fine filtering of water right before use (in hospitals, nurseries, schools etc.), and this calls for development of compact technologies relating to water purification. Experience gained in such developments within "Clean Water to Children" Project undertaken in Nizhegorodskaya Region has shown that a far reaching variant here is a flexible technology based on module performance of separate technological units.

Such technology has been implemented as an automated complex of fine filtering of water (ACFFW) developed at research company "Sudoechotechnika" of Volga State Academy of Water Transportation, Nizhny Novgorod, and which is widely in use for water supply.

The complex is based on shipboard water purification technology which has shown good results with standard stations 'Ozone' type that have been making drinking water aboard thousands of river vessels these 25 years.

The technology presupposes the use of a two step head sand filtering, automatic flushing with consequent two step ozone enriching of water. Yet water quality analysis has shown that the use of Ozone ship water stations poses a problem due to a variety of chemical composition of secondary pollutants as well as due to the lack of a continuos water quality control.

These drawbacks have been eliminated in ACFFW having modules of fine chemical purification and of water quality control. Fine chemical purification module embraces various filter types depending on source water in a line: absorbs, ionic etc. Drinking water quality control module owing to its continuous action enables to drastically reduce an acute pollution risk in water supply. The module is based on potentiometric technique approved of by a former USSR Ministry of Health, and is composed of a quality control meter and a system of electromagnetic valves.

The module denies water supply to a consumer if a reduction-oxidation potential is below a given value when a guaranteed quality of water supply is uncertain.

This quality module has been full scale tested and approved of by the Government Authority Control.

A prominent feature of ACFFW is a module of water line desinfection. This module functions with the use of higher concentration of a residual ozone that can be effected in a net of water lines when the water supply is normally low, e.g., at night.

The module operates automatically and accounts for water flow discharge amount. It may be used to continuously maintain a guaranteed water quality in a waterline net, as well as to disinfect the water in the net after repair works.

Experience of ACFFW use in nurseries of Nizhegorodskaya Region within "Clean Water to Children" Project has proved its undoubtful advantages and reliability, and its operation maintenance requires low cost expenses.

Finally, ACFFW flexible technology enables to develop various drinking water stations at a minimal risk of pollution meeting the demands of a water consumer to its best.

PURIFICATION OF THE PORTABLE WATER BY DOLOMITE COAGULANT'

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It is known that sulfates and chlorides salts of aluminum and iron are used in water treatment as coagulants. The creation coagulants on basis other more accessible has large national economic meaning in condition their deficit. Exploration results of receiving and using coagulant form local dolomite are results in this work. Roasting and hydration processes was studied of roasting dolomite depending on from temperature, relation liquid solid, duration and other factors. Mineral condition was determined of initial raw material roasting products and hydration dolomite according to chemical and differential-thermal analyses. Hydration dolomite is keep hydrated oxide and in important admixtures in reaching carbonate oxide of magnesium and calcium by roasting condition. Coagulation properties of receiving substance are studied for different types of portable waters with maintenance weighting substance from 60 to 300 mg/l by norms of carring in coagulant. Degree of cleaning water from weighting substance is answer demand DOST for all optimal condition.

Sorption properties of dolomite coagulant are studied at the same time with coagulation, as regards admixtures of humic acids, phosphor-ions and solution of silicic acid sorption. Sorption this admixtures was studied with their content in interval (mg/l): humic acids 1:80; phosphor-ions 1:207; silicic acids 40:100 in broad limits of dose carring in coagulant. Sorption degree indication admixtures is compose more 90 % in optimal conditions.

Receiving coagulant may by successfully used also for clarification and purification production waters.

MICROBIAL METHOD FOR ENVIRONMENTAL PROTECTION THE BEST WAY? TEMPORARY MEASURE? DESPERATE ATTEMPT?

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Nature has almost exhausted its potentiality to resist to the unceasing stream of toxic and recalcitrant compounds. Wastes from mining, processing and producing industries have exceeded all conceivable nature protection norms long ago. Weak environmental demands and penalties system in Russia allow them to pollute soil and water by minerals and products of their processing, to dispose of toxic wasters through powerless treatment plants (or passing them), to convert air into aggressive gas mixture.

Biological treatment is considered the most cheap method for pollutants detoxication. However, aeration tanks and biofilters do not cope with high toxic loads; soil and water, even after removal of pollutants bulk and land-reclamation, are restored very slowly, and toxic compounds, meanwhile, migrate around.

Microbial treatment today is the most effective method among biological ones. It is based on ability of selected (adapted) or constructed microorganisms to utilize toxic compounds as sole source of carbon and energy at high concentrations. Active microbial complexes are used in compact bioreactors for (pre)treatment of local strong wastewaters, are introduced into activated sludges or into polluted environments objects, In our institute tens of model microbial biotechnologies were elaborated, tens of microbial cultures were successfully tested in model natural ecosystems polluted by xinobiotics. Other institutes from former USSR have achieved greater practical progress.

However is it worth a rapture?

In the first place, biodegradation is the synonym of annihilation. Concentrated wastes contain large amount of recoverable products. Ordinary phenol production plant in Russia loses about 0,4 t. of this compound everyday with wastewaters; technology of benzaldehyde production allows a loss of the product up to 0,5 t.; metaphos (methylparathion) production - up to 0,6 t. of nitrophenol; diphenylamine production - up to 0,15 t. of aniline... and these are not the most wasteful industries. During microbial purification of such effluents the great expenditure of labor and material values are annihilated. Petroleum and gas-wastes converted by microbes into biomass cause financial losses too.

In the second place, whereas the risk of genetically engineered microorganisms application is a subject of scientific debate, a question on environmental safety at massed introduction of natural (but altered by selection and adaptation) strains is not discussed practically. We have determined that microbial cultures isolated from environment and adapted to toxic substrates could manifest high ecological activity, i.e. could course changes both in anthropogenic (activated sludges and biofilms) and in natural biocenosises.

Certainly, microbial method is irreplaceable in extreme situation but it should not be accustomed to these means as to drastic medicine, It is

necessary to normalize industrial technologies and then potentialities of ordinary biological treatment plants and natural ecosystems would be sufficient for xenobiotics degradation. Experience of some developed countries is evidence of that.

THE EFFECT OF INORGANIC AND ORGANIC IMPURITIES IN WATER ON PROCESSES, PROCEEDING ON THE METAL/SOLUTION INTERFACE

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In order to investigate the processes, proceeding on the phase interface, including the processes in electronic technique, it is necessary to get water, free of inorganic and organic impurities. The necessity of indicated impurities determination is connected with the phenomenon of the essential modification of solid surface properties due to the impurities adsorption. Nowdays for the determination of the total content of the organic impurities in water the methods of the oxidimetric detection are used, when the consumption of the oxidizing agent-titrator is consdered as measure of the oxidizable impurities. However, permanganate as well as bichromate methods are low-sensitive and poorly reproducible; furthermore, not all classes of the organic compounds may be tested with this methods. At present time in order to obtain pure water, the distillation methods, based on application of ionic-exchange resins, are used. Water, producing by this methods, contain the impurities because of the organic impurities diffusion from ionic-exchange resins to water; so when the distillation takes place, it is also impossible to obtain pure water as a result of the drops carry-over and the water layer on the apparatus shells.

At present paper the investigation of the possibility of obtaining water,free of the organic impurities and possessing the value of the specific electric conductivity close to theoretical, was carried out. The water obtaing device was created on the base of the cascades, designed by academic I.V. Petryanov, where the drops carry-over and the water layer motion along the vessel walls are absent. For the determination of the summary organic impurities content the effect of the mercury surface tangential motion retardation by the organic compounds of the second type was used. The sensitivity of this method is 10^{-9}<M>mol/l.The value of the specific electric conductivity of water, obtained on the <D> I.V. Petryanov<M>s cascades, is equal 0.090×10^{-6}<M> Om^{-1}<M>cm^{-1}<M>, when <D> temperature is 25^{0}<M>C. According to our of many years tests, the quantity of the organic impurities in water,subjected to the thorough purification, at last years rises because of the increasing impurities content in natural water.

USE OF FLOCCULANTS IN WATER CONDITIONING

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A number of physico-chemical properties of the system: natural water + calcium hydroxide + flocculant has been studied in order to replace coagulants by flocculants in clearing natural water softened with calcium hydroxide. Polymers of domestic high-volume production such as hydrolyzed polyacrylamide (HPAA) and hydrolyzed polyacrylonitrile (HPAN) were used as flocculants.

The influence of 1) way of introducing a flocculant; 2) mode of systems agitation; 3) concentrations of calcium hydroxide and a flocculant; 4) flocculant molecular properties on degree of the given system clarification was studied employing the method of turbidimetry.

Optimal conditions of calcium hydroxide particles binding with HPAA and HPAN providing the clarification degree up to 99,4% and 97,6%, respectively, have been determined. The optimal HPAA concentration has been shown to be ~ 15 times as less as that of HPAN.

A way of employing HPAA under the industrial conditions has been developed including dissolving, supplying, metering out the flocculant in the continuous mode of the clarifier operating. The quality of softened water for boiler feed has been shown to meet the norms accepted.

No changes in the technological scheme of clarifying softened natural water are required owing to employing a flocculant instead of a coagulant.

An evaluation test of the proposed method was passed at Heat Power Station 1 in Saratov, Russia.

CHARACTERISTICS AND WAYS TO IMPROVE DRINKING WATER SUPPLY IN THE REPUBLIC OF KALMYKIA

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Analysis of utility-drinking water supply in the Republic of Kalmykia has shown that ground waters from 26 deposits that are used now as water sources do not meet the requirements of GOST 2874-82 Drinking Water'(mainly due to increased content of hardness minerals, a number of heavy metals), and the intensity of anthropotechnogenic contamination of surface water sources (the Volga river, Krasinskoie and Chograiskoie water reservoirs, Pravo-Yegorlyc irrigation system) has also significantly exceeded the limits allowed for the existing at waterworks technologies of water preparation. Only 58% of the population of the Republic get water from the centralized water supply system. 76% of rural population get water from mine wells, open water reservoirs, including canals. 25% of urban population are in the same situation. A thorough analysis (accirding to 70 parameters) of tap water quality in 14 residential locations with the total population of 192 thousand people, which is 58% of Kalmykian population, carried out by us has shown that about 60% of samples do not meet the hygienic standards according to organoleptic properties (turbidity, colour, presence of additional taste), level of mineralization, hardness, sodium, chlorides, sulphates content, in 75% of samples the complex indice of toxic elements of the I ans II classes of danger was exceeded (2-10 times), 21% of samples had deviations as far as organic contaminants are concerned. The results obtained correlated with the percentage (62%) of nonstandard samples in biotests on hydrobionts; all samples were characterized also by insufficient fluorine content. Mutagenic activity of water was identified in 30 % of samples.

For these conditions we have developed two main technological schemes of water preparation for obtaining water of drinking quality on the basis of national mass-produced equipment: 1-st:oxidation, filtration, sorption, desalination, deodorization, fluorination and disinfection (for 8 residential locations), 2-nd: the same stages, but for desalination and deodorization (for 6 residential locations).

With an account for the obtained results and technico-economic calculations a new concept has been developed of separate water supply taking into consideration differentiated approach to the quality of water meant for different purposes: drinking water (initial water conditioning using the mentioned above technologies); for utility-household needs (centralized system of supply with water the chemical composition of which does not meet the requirements of drinking water, but which is safe from the epidemic point of view).

Drinking water supply systems can be centralized (a complex of drinking water preparation is located near water intake point and the construction of an additional arrangement of a drinking water network, i.e.a duplex system is established) or decentralized (drinking water preparation devices are spread around the whole territory of a residential location and treat water from a single pipe-line network in the vicinity of the place of consumption).Drinking water in such a situation can be taken from street devices or from a tap (if a second tap is in the house or apartment). Mantling of local devices in pre-school and educational establishments, hospitals, industrial enterprises and official buildings is also envisaged.

As calculations have shown, the minimal norm of 24-hour water consumption for drinking purposes and cooking being 12 litres per person,58 devices with the capacity of 25m^3/24 hours will have to be mantled, 68 devices with the capacity of 15 m^3/24 hours and 619 devices (for some establishments) with the capacity of 2 m^3/24 hours.

Investments into the decentralized water supply system would total the sum equivalent to 25 million $ or 76.2 $ per person, the average calculated cost of preparaqtion of 1 m^3 of water would be 0.96 $. The price of 1 litre of water for consumers receiving the water using their own vessels would be 0.125 cents (additional prices included) or (at the exchange rate on 01.04.1996) 6.1 roubles, which is significantly lower than the cost of water with the use of other technological methods.

The given above calculations testify to the fact that in extreme situations the mentioned technological decisions, including the use of decentralized systems of additional water treatment, make it possible to rapidly, efficiently and most economically solve the problem of supplying good quality drinking water to the population in regions with an ecologically unfavorable situation as far as the water factor is concerned.

QUALITY IMPROVEMENT FOLLOWING INVESTMENT

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Severn Trent Water provides water services to a population of 8 million people in the centre of England. It was privatised in 1989 when a set of regulations were introduced to monitor and control, prices, investment and services.

Between 1989 and 1995 Severn Trent Water was allowed to increase charges in excess of the rate of inflation in order to provide sufficient funds for substantial investments in water treatment, distribution, sewerage and sewage treatment.

To meet the EU Drinking Water Directive, considerable in investments had to be made, primarily in GAC and ozone, at a total cost of US $939m. The paper describes how the investments ware made and details how the compliance with EU standards has risen to 99.8% since 1989.

The discharge consent standards for sewage effluents are set by the National Rivers Authority (NRA) and, being land locked, Severn Trent Water has no sea outfalls providing cheaper and less stringent disposal options. In 1985/6, 400 of the Company's 1078 sewage works failed to meet consent standards; but following an investment of US $1,183m between 1989 and 1995, only one effluent now fails to meet the standards.

The paper describes the improvements gained in water and sewage treatment following extensive investment between 1989 and 1995.

NEW ACTIVATED CARBONS FOR WATER PURIFICATION

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Lately, because of new demands to water quality, there^s necessareness to use better methods for its preparation.

One of them is purification by activaed carbons. Extraordinary properties of activated carbons let them remove a very wide spectrum of contamination, first of all the most toxic elements: pesticides, dioxines, biphenyles, etc.

Concentration of such substances, as a rule, is very small and other methods of activated carbons made of different raw materials. There^s no other producer of activated carbon, but JSC "SORBENT".

Experience pf powered activated carbons use for water purification in different regions showed that their selection, modification or even working out are very important for each watersource and for technology of water purification in water-treatment plants.

Water particularities needs to take them into account if we want to get better effectiveness while using expensive activated carbons.

Together with specialists of State Central Research Institute VODGEO and MOSVODOKANAL Research Institut, JSC "SORBENT" worked out special types of activated carbons SKD -515 for MGP "MOSVODOKANAL" and SPDK-27D for "UFAVODOKANAL".

These activated carbons meet special needs of consumers(structure of porosity, fruction composition, additives). While manufacturing, the quality of carbons is tested according some indexes. This guarantees high effectiveness of their use.

It is important to mention that, because of technology, activated carbons are produced with different hydrogen indexes and degree of moisture content. For easy use of carbons their moisture content can be 55-58%. This procedure let us reduce dust formation and improve conditions of work.

Effectiveness of water purufucation by new activated carbons demonstrates the results, showed in the picture 1 and 2. The lab results are cofirmed by practice.

In August1995, when there was an accidental situation in Ufa, drinking water pipe-line was protected by activated carbon SPDK-27D. This carbon showed its effectiveness. The content of benzapyrene and other impurities became 7-10 times less.

TECHNOLOGIES AND EQUIPMENT FOR DRINKING WATER PRODUCTION AND WASTE WATER TREATMENT

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Apart from the construction of large water production plants development of local system for water production becomes much more actual especially for collective use (condominiums, hotels, hospitals, etc.) and individual use (cottages, apartments),

Plants and instruments for natural water treatment or tap water polishing are based on achievements of advanced chemical technologies. The plants and instruments feature various combinations of methods of electrochemical, sorption or membrane water treatment.

Electrochemical methods combined with micro- and ultrafiltration provide clarification and decontamination of natural brackish water. Sorption methods allow the removal of organic compounds including phenols and heavy metal compounds from water. Membrane technologies provide the production of high-quality drinking water from brackish and saline natural water including sea water. Plants of various type and size with a capacity from 0,1 to 10 m^3/hr for collective use have been developed.

Equipment and devices for individual use are based on the same technologies with a capacity from 2 to 10 l/hr.

Common and widespread problems of waste water treatment boil down to necessity of removing suspended solids, oil and oil products, organic compounds containing chlorine, nitrogen, phosphorus; phenol and its derivatives; mineral acids and alkalis; heavy metal salts fats, proteins, etc. from food processing and agroindustry.

The problems are solved by combined methods of mechanical filtration, chemosorption, catalytic oxidation, galvanocoagulation, electrodialysis, reverse osmosis biochemistry. The method of fire decontamination is used for treatment of waste water containing highly toxic compounds. Sludge is processing using methods of separation, catalytic digestion, composting.

The treatment technologies offered realize two key principles: localization of effluents to be treated and development of partially or completely closed recycling system with a minimal amount of waste dumped to the environment.

CERTIFICATION OF WATER SUPPLY SOURCES, THE BASE FOR DEVELOPMENT OF REGIONAL REQUIREMENTS TO WATER QUALITY

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One of the main factors of favourable conditions of human life and activity is the quality of potable water consumed. In this connection the quality of water used by population as potable or for production aims, water of centralized and non-centralized water supply sources as well as the other water objects should satisfy the standards implied.

The main document, stipulating hygienic requirements to potable water in Russia is National Standard 2874-82 "Potable Water", while the requirements to water sources are defined in National Standard 2761-84 "The Sources of Centralized Potable and Industrial Water Supply", which determines 30 indexes, defining levels of safety, harmlessness and other organolepthyc characteristics of water subject to compulsory control.

Abovementioned indexes include mainly polluting components, containing in natural water and introducing into potable water during its preparation, but actually these indexes do not consider the sewage water of industrial, agricultural and civil origin that affects the sources of water supply. Due to this fact a number of toxic metals and organic substances are not included in the list of indexes subject for compulsory control. In order to avoid this negative fact National Standards stipulate that concentration of chemical substances which are not indicated in their tables, but are detected in the water, should not be higher than maximum permissible concentrations (MPC), approved by the Sanitary Standard No. 4630-88 "Sanitary Rules and Standards for Day Water Protection from Pollution". In order to apply these standards it is a normal practice to select from total number of pollution indexes some minimum set of indexes which are typical for this particular region. Furthermore, after the water supply source and water preparation techniques selection is completed, relevant documents now in force do not stipulate standardization of potable water quality

depending on water supply source state. In the same time the potable water quality with existing water preparing techniques depends directly on the quality of water supply source. It is important to note that the pollution of day water in many regions became higher during the last several decades.

Regional approach to standardization of water quality of centralized systems of industrial and potable water supply is stipulated by the project of new Sanitary Standard which in comparison with National Standard 2874-82 significantly widens the list of indexes standardized and stipulates the system of selecting water polluting indexes that should be controlled. For the first time dependence between the water supply source quality and potable water supplied to population will be stipulated by the project of new Law of Russian Federation "About Population Providing with Potable Water" from the point of view of water supply source pollutor's financial liability and covering expenses on polluted water refinery and reimbursing these expenses to enterprises which perform water preparation.

Presently the potable water of centralized systems is not subject to compulsory certification. However, enterprises which perform water preparation are liable to provide its quality. We think that quality standardization of water, that is supplied to population by centralized water supply systems (and consequently its price) should depend upon the quality of water supply source in particular region, while the development of various water preparation systems should be financed by the compensations paid by the enterprises and institutions-pollutors of water supply sources, including water pools of such sources. In order to define the direction of work and approve regional programs aimed at improvement of water supply to population, it is necessary to carry out at the first stage certification of existing and perspective water supply sources.

On the basis of complex research (certification) of water supply source, local authorities should develop regional requirements to water supply source and potable water quality control as well as additional requirements to water preparation system depending on the water supply source state and the possibility of using alternative source of water.

WATER FLOW CONTROL AND MANAGEMENT BY USING THERMAL FLOWMETER "CYCLONE"

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Modern conditions of environment demand urgently the introduction of common automated systems to measure, to control and to manage water flows. It is necessary in particular to prevent technogenous catastrophes (such, for example, that happened at the sewage purification works in Kharkov in June 1995).

Industrial flowmeters that are able to indicate a value of the flow rate a liquid (or a homogenous mixture) with a desired degree of accuracy in the real time conditions, are a necessary element of any system of mentioned type.

Without touching problems of network provision on the whole here, we will further consider only the mentioned element of the network. We offer a partial thermal flowmeter "Cyclone" as it is. This device is designed to measure mass and volume flow rate of liquids, gases and gomogenous mixtures in individual and network conditions.

The device is covered by patent in Russian Federation and the Ukraine, and has been working successfully in Russia and the Ukraine since the early nineties.

The operation principle of the device is based on the determination of thermal exchange between a flow and the surface of a thermal probe placed in it. Thanks to the application of the idea of partiality, the flowmeter "Cyclone" consumes insignificantly little power while it is in use as compared with thermal flowmeters of other types.

Its main advantages in comparison with the known devices to measure flow rate are the following:

- high manufacturability during mounting and repair, longer repairless operation time;
- low sensitivity to pollution;
- application of sensors of standard size for pipe-lines of different diameters;
- wide range of measurements (1:100), less error;
- measurements are taken without reducing carrying capacity of pipe-lines, without application of mobile elements in the flow and throttling devices;
- weaker influence of medium composition on the accuracy of the measurements;
- device readings independence on a radial orientation of the sensor in the flow;
- lower prices.

The flowmeter "Cyclone" can be used efficiently in the systems of water-supply, measurement and control of water resources and water management, water removal and sewage treatment, monitoring of waters.

RECONSTRUCTION OF WATER FILTERS. THE REGENERATION, UNDERDRAIN AND BACKWASH COLLECTION SYSTEMS

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Rapid filters are the main constructions in water treatment plants. The quality of drinking water depends on their work, efficiency, economy and reliability of their functioning mostly rely on the method of the filter bed washing, the construction of the underdrain and backwash water collection system.

The investigation of possible ways of rapid filter intensification having great importance in the period of economic crisis. Were carried out at water supply department of OSABA. New methods of bed regeneration and improved underdrain and backwash water collection system are given.

The revolutionary type of backwash (backwash with alternative intensely) was developed. There are the bed zones with increased and lowered intensely during backwashing resulting bed intermixing and so reducing hydraulic grading. These filters eliminate a problem of fine media grain accumulation on the surface of the media and thus have up to 30% longer runtime and use backwash water by 30-40% less than conventional filters.

It is know that underdrains should not admit the loss of filter media and equally distribute the backwash water. Thus the hydraulic underdrain parameters should not be worsened at long maintenance. Besides the deterioration of effluent quality the deterioration of effluent quality because of interaction between underdrain material and influent or regenerating solution should not take place in pressure filters. Porous polymerconcrete or polyctyrol underdrains constructions of which have been developed in water supply department satisfy to all listed requirements and successfully are used in rapid and pressure filters.

The traditional backwash collection system dose not always provide the uniformity of removing backwash water and elimination of the filter media loss. Some constructions from porous polymerconcrete were developed and investigated.

The backwash collection system (the porous inclined wall and porous pipes) has been successfully maintained on eight rapid filters of Inguletsk water treatment plant in Nikolaev since 1987. The advantages of utilisation of these systems are: (1) drastic decrease of media loss, (2) improving collection backwash water. It allowed to reduce the use of backwash water and to increase the effluent consumption up to 8-10%.

The porous backwash collection systems are successfully maintained in pressure filters and thus has allowed to reduce the loss of extensive ion-exchange and sorbtive materials.

The developed intensive methods of washing as well as the improved underdrains and backwash collection systems can be used separately and complex in new constructions, in extension or reconstruction of structures. These constructions work successfully at 140 filters of 15 water treatment plants in the CJS having the output more than 1 million m3/day. Their high productivity has been proved at 46 pressure filters.

THE AUTONOMOUS WATER-SUPPLY SYSTEMS: THE COMPARATIVE ANALYSIS

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The water supply problem of city consumers by potable water remaining urgent newdays includes the quantitative and qualitative aspects and can be achieved in several ways: (1) reonstruction of water treatment plants for the purpose of improving of the water quality; (2) aditional treatment of running water for drinking needs of population; (3) search and development of new clean water sources (for example, underground). The criteria of estimation and comparative analysis of these methods are under discussion.

Some variations of water supply systems are considered in this article with using the date of the Odessa waterworks. They are based on the methods mentioned above some criteria are proposed here according to their estimation:(a) maufacturing maintenance and transformed costs; (b) sanitary-hygienic /quaranteed and stable potable water, reliability of its maintenance and control by State sanitary inspectors and consumers/; c) comfortability for consumers. The following versions are discussed; **1/** reconstruction of municipal water supply systems; **2/** clearing and packing water selling it in shops; **3/** district water treatment plants with realisation of water in consumer contains; **4/** district plants for water sale in consumer contains;

5/ local water treatment installations in dwelling houses transporting water to flats by special drinking network; **6/** the same installations are at enterprises (in drinking-rooms for workers); **7/** compact water treatment installations in hospitals, schools, hotels, restaurants etc.; **8/** point-in-tap installations. The results of economic and expert estimations (experts - technologists and hygienists) and arrangement of received data are given in the table (the system of marks of numbers from 5 to 10 is used):

Table

Range	Parameters					
	Cost $/man	ordin. syst. N	san-hyg number	ordin. syst. N	comfortab. numbers	ordin. syst. N
1.	0.28-1.22	6	9.62	5	9.85	5
2.	1.38	3	9.5	7	9.68	1
3.	1.47	4	9.33	2	9.27	8
4.	1.89-3.68	7	9.18	6	9.14	7
5.	3.9-8.37	5	8.95	8	8.91	6
6.	1.96-18.9	8	8.59	3	6.82	3
7.	64.0	1	7.5	4	6.64	4
8.	270-406	2	6.5	1	6.5	2

It is clear from these data that the cheapest variants are **6, 3, 4** and **7,** however according to the variants **6** and **7** only limited quantity of consumers receives water of high quality. Sanitary hygienic and comfortable estimations are not high in variants **3** and **4**; the highest estimations of this kind have appeared in variant **5**.

Variant **8** (point-in-tap) can be related to rather cheap and comfortable, but their sanitary hygienic parameters are not high (because of insufficient reliability of known structures and absence of service).

The most expensive variants are **1** and **2,** but the variant **1** has received the lowest sanitary hygienic estimation and at the same time its comfortability rather high. The variant **2** has got low comfortable and high sanitary hygienic estimation.

Taking into account rather high parameters of variant **5,** it is seemed expedient to use such installation in designing of new dwellings. The installations (according variants **6** and **7**) should be included in projects of public and civil building. The existing building can be equipped by these installations. The variant **3** and **4** of district plants are proposed for water supply of the majority of population in towns and cities.

WATER SUPPLY AND WATER DIVERSION PROBLEMS IN NOVOSIBIRSK

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Novosibirsk is one of the largest cities in Siberia and Far East. The Ob river is the main source of water. The water supply system includes two bucket watersheds and one channel flooded water intake with two riverside collectors combining with pumping stations of the first stage, four plants preparing potable water with a design capacity of 1 mln. m^3 per day. The length of the water supply network is more than 1200 km. The water consumption volume is 900.000 - 950.000 m^3 per day. The general potable water reservoir volume is 121.000 m^3 which represents 13 % of the day water consumption. It is obviously that such volume of reservoir for a city with a population of 1.5 mln persons and a large constructional area is not enough.

Potable water preparation at all plants is done according to a classic reagent technological scheme with filtering and setting. As a chemical reagent aluminum sulfate with polyacrylamid is used in the periods of flow temperatures.

The quality of water corresponds to the requirements of "Potable water" State Standard 2874-82. With the introduction of new sanitary regulations and norms of the Russian Federation it became not so easy to meet sanitary-hygienic requirements under traditional technology. Unfortunately, the quality of water in the river Ob is not being improved.

Reliability of the water supply depends to full extent on the technological condition of a water supply system.

65 % of all the length of networks have been made of steel pipes without any internal

protective coating and the rest has been made from cast-iron pipes. More than 250 km have maintenance period of 50 and more years. It is necessary to change them completely. Because of this fact water supply networks operate under hard conditions. The damage of the network is increased. In 1994 their number reached 46.

Resetting of networks is done very slowly and in traditional manner.

The following amount of work has been done to increase sanitary-hygienic potable water requirements and to secure the reliability of water supply system:

- New water treatment technology with the help of aluminum oxidechloride was introduced. It allows not to use polyacrylamid, not to use chlorine process, to decrease the usage of coagulant in 6 - 7 times in comparison with aluminum sulfate, to decrease in 1.5 the operational expenditures.
- New methods of repairing without making excavation were introduced.

The second and not less important problem is the problem of purification of waste water treatment and the usage of sediment. The system of general floatable and to some extent combined system of water diversion is typical of Novosibirsk.

The beginning of networks construction dates back to 30th. More intensive construction began in 60th. The length of water diversion networks which are in the responsibility of "Gorvodokanal" is more than 900 km. The general number of waste water is about 1.2 mln. m^3 per day. Waste waters is pumped by 28 pumping stations. The capacity of sewage purification plants is 800.000 m^3 per day. According to a design purification should be done using the following scheme: mechanical and full biological purification in aeration basins, the process of fermenting in methantenks under the temperature of 50-55^{0}C, vacuum-filtration and thermodrying of sediment.

Water plants secure the decrease of pollution concentration in purified sewage up to 15 mg/l in solid and the same concerning the biological index of quality (BIQ). The question about sediment treatment is very urgent. Installation for thermodrying has not been put into operation. All sediment is transported to "reserved" silt fields, the area of which is 75 hectares. More than 1433 thousands cubic meters of sediment have been accumulated. It can't be used as a fertilizer because of heavy metals salts. Annually more territories are required. Ecological situation is rather difficult. It is necessary to work out and to introduce ecologically pure modern sediment treatment technology, suitable for Siberian conditions.

The first stage of such technology at water purification plants has been done Novosibirsk in 1995. Complicated vacuum-filters were dismounted. The centrifuge and the centripress of the firm "Humbolt" were assembled and put into operation. Two more centripresses capable to treat all sediment volume up to 68-70% humidity was planned to assemble in 1996. This line of utilization of sediment is being constantly worked out.

Head collectors made of steel pipes with a large diameter need complete reconstruction. Collectors of deep stratification are of great concern.

The settlement of these problems is impossible without new modern methods and technologies, equipment and machines. Bathing machines of the firm "Hellmers" were acquired, the installation of TV survey of pipelines (firm "IBAK") was acquired too. An agreement about the establishing of a joint venture with "Insituform" for reconstruction of pipelines was signed.

The problems of water supply and water diversion of a large city can be solved only by joint efforts of the municipality and "Gorvodokanal". Nowadays the plan of technical restructuring water supply system has been worked out in details. The ways of investments attraction have been outlined.

CHLORINATED HYDROCARBONS IN DRINKING WATER IN IVANOVO

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Formation of the chlorinated organic compounds in natural water is the result of the transformation of the hydrocarbons, including the process of water organisms vital functions or the result of the preparation of drinking water during chlorinating. The second case of the formation is more studied. Oxocompounds, that have one, or several carboxy groups in m- or p-position (the typical representatives are humus acids) and the compounds, that contain phenolic hydroxylic groups, which we capable of mesomeric effect with formation of carboxy compounds, that are responsible for the formation of chlorinated organic compounds. 'The aim of this research was the control of the concentrations some chlorinated organic compounds in the Uvodskove reservoir's water, which is the main source of Ianovo's water-supply, and in drinking water. The seasonal changes of the content of chemically and 'biochemically oxidising organic compounds in Uvodskoye reservoir's water(the average from 5-8 stations of observation') are in table I, and the changes of content of oil's hydrocarbons and of volatile phenols are in table 2.

Table 1.
The meaning of BAO_5 and CAO (permanganate oxidizability) of the Uvodskoye reservoir's water in different seasons.

Season	BAO_5		mg O_2/l		CAO,		mg O_2/l	
	1992	1993	1994	1995	1992	1993	1994	1995
Winter			2.03		7.3		7.3	
Spring	1.57	2.88	1.71	2.27	7.8	5.8	8.9	10.3
Summer	2.45	1.96	1.37	1.67	6.7	6.0	8.2	9.6
Autumn	1.46	0.26	1.22	0.94	7.4	6.2	6.9	8.4

The table's data show, that the concentrations of lightly oxidising organic compounds in the reservoir's water are not large, and their contribution to the probable formation of chlorinated hydrocarbons during chlorinating of water is unlikely.

Table 2.
The seasonal change of the oil production's concentration and the volatile phenols concentration in Uvodskoye reservoir.

Season	Content	of oil	prod.,	mg/l	Content	of vol.	phenols,	mg/l
	1992	1993	1994	1995	1992	1993	1994	1995
Winter			0.009				<2	
Spring	0.79	0.40	0.204	14.4	37	14	4.6	8.9
Summer	0.29	0.88	0.28	1.35	11	21	9.0	8.7
Autumn	0.14	0.23	0.26	0.27	24	27	5.0	6.2

Oil's hydrocarbons and phenols are another group of compound we which are able to initiators the chlorinated organic compound's formation. The results of the measurements snow, that there is a tendency of growing of the average annual concentration of oil's hydrocarbons in surface layers of water for the last 4 years and for phenols there is an opposite regularity. There aren't any regular seasonal variations of the compound's content. The results of the changes of concentration of chlorinated hydrocarbons by the entrance to the water-point and in water-point are in Table 3.

Table 3.
Average annual concentrations chlorinated organic compounds in Uvodskoye reservoir's water, on drainage canal and in drinking water (water-point).

Compound	Concentration,	mg/l	
	reservoir	drainage canal	water-point
$CHCl_3$	9.3	<5	20.3
CCl_4	2.9	<1	<1
C_2HCl_3	1.4	0.4	<0.4
$C_2H_4Cl_2$	<6	<6	7.3

The results of measurements show the increase of the content, as the result of chlorinating, $CHCl_3$ and $C_2H_4Cl_2$, the concentration of CCl_4 and C_2HCl_3 decreases.

PHYSICAL AND TECHNICAL PRINCIPLES OF EXPRESS CLEAN WATER PREPARATION BY USING THE SOURCES OF A OZONE AND ULTRAVIOLET

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In a number of cases a fast and effective desinfection of water is necessary. First of all, it concerns to preparation of a water for the medical purposes in conditions of extremal situations.

Bactericide and deodorate action of the ultraviolet (UV) irradiation and ozone it is known for a long time and is widely used for the decision of a problem of a clean water preparation in many countries. We pay attention of the researchers and technologists on the possibility of combined using of the UV and ozone. The capability of combined UV/OZONE Technology for deciding the problem of clearing and desinfection of water is stipulated by unique properties of excited ozone-oxygen gas

mixture as an environment for chemical reactions. Therefore, by combining sources of a ozone and UV-irradiation, it is possible considerably increase oxidizing reactions rates with participation of excited molecules and atoms of a oxygen and molecules of ozone.

For checking properties of combined UV/OZONE - technologies we created a UV and ozone sources and assembled laboratory variant of a clean water preparation system. The microbiological researches on efficiency of desinfection of a water are conducted. Positive results are received.

The plasma UV light source represented the line or the grid of high current spark microdischarges with maximum or irradiation in a spectral range 170 - 300 nm. It is known. that in this spectral interval there are two bands of photoadsorbtion of DNA of bacteria and viruses at wavelength of 190 nm and 260 nm. This is causes the wreck of microorganisms.

The compact ozone-oxygen gas mixture generator is provided the ozone output with concentration up to 2% at the oxygen consumption of about 10 liter per hour. The ozone concentration could be adjusted over a wide range as at the expense of change of consumption of a oxygen, as at the expense of regulation of electrical parameters.

The UV and ozone sources can as in conditions of extremal situations, when are usually used stand-alone power supplies with a voltage of 12 V.

It was carried out the optical exciting of thin layers of ozone-water mixture. During the process of UV irradiation of ozone-water mixtures the ozone is particularly degrading to the metastabile excited particles:

$$O_3 \rightarrow O(^1D) + O_2(a^1\Delta).$$

The radiating lifetimes of the atoms $O(^1D)$ is 110 sec., the lifetimes of the molecules $O_2(a^1\Delta)$ is 3900 sec. The energy of excitation is 1,97 and 0,98 eV accordingly. The reaction ability (oxidation) at atoms of a oxygen is much higher, than at a ozone, and the internal excitation of particles strengthens it more.

The optical exciting of a gas-water mix in view of further reactions resulted in availability in a water of high concentration active radicals $O(^1D)$, $O(^3P)$, H, OH, and active molecules O_3, HO_2, H_2O_2. Also the UV irradiation actively influenced on given environment.

The equilibrium generation of the radicals with increased oxidizing potential in water-oxygen environment provided appreciable acceleration of process of clearing and sterilization of a water.

This work is executed at the support of Russian Foundation of Fundamental Investigations /RFFI/ (grant № 94-02-05359-a).

PROTECTING MOSCOW'S DRINKING WATER SOURCES THROUGH INTERNATIONAL COOPERATION

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Citizens of Moscow have become more concerned about environmental problems, and in particular, the quality of their drinking water. Despite the fact that Moscow has some of the most advanced water treatment facilities in Russia, municipal, industrial, and agricultural sources of pollution within drinking water supply catchments are numerous, and often not sufficiently controlled. Projected costs for infrastructure modernization in the Moscow Region are very high, and must be prioritized based on a truer understanding of health risks and investment effectiveness.

TheU.S.Environmental Protection Agency (EPA), through funding from the U.S. Agency International Development (AID), has become a partner with many dedicated Russian and U.S. organizations and individuals, to address this problem. Demonstrations of different pollution control approaches have been in operation for-about 2 years in Moscow, Smolensk, and Tver Oblasts. These demonstrations seek to find solutions which are appropriate to the Russian hydrologic, socio-economic, and legal framework, yet take advantage of pollution control experiences gained over the last 25 years in the U.S. and Western Europe.

Some of the interventions have already proven their value. Industrial enterprises can modify certain processes rather inexpensively, which can lead to less pollutant generation, lower fines from regulatory authorities, and place these facilities in a more attractive position for capital investment. Halting catastrophic, manure-laden runoff from animal feedlots, can be accomplished with simple technologies. Environmental education programs for school-age children, helps communities conserve available water supplies, and trains the next generation of environmentally-responsive leaders. Improvements in monitoring of drinking water sources, and more accurate assessments of health risks within drinking water systems, provide local officials and Vodokanal specialists with the tools to help guide the extent and timing of infrastructure improvements. Many pollution control reforms can be made within the existing legal framework.

The U.S./Russia partnership on Moscow's water has been enhanced through informal cooperation with other donors and multi-national organizations.

As in Eastern Europe, however, true water sector reform in Russia is dependant on overcoming a number of financial, institutional, and legal obstacles. Stronger incentives for industrial pollution control investment, rationalization of water quality criteria, and resolution of certain sensitive land use issues, are key problems ahead. New approaches for complex problems must be found. The U.S. and Western European experience in uniform adoption of technologically-based water quality limits on discharges, for example, proved extremely expensive, and is now being tempered with watershed-based approaches. Sector reform for Russia might be based on a model which moves more directly to this holistic concept. It is our hope that the U.S./Russia partnership in the Moscow Region will continue to provide practical solutions to address water problems in Russia.

SEARCH FOR EFFECTIVE COMPOSITIONS TO PREVENT RECIRCULATING WATER SYSTEMS AGAINST BIODETERIORATIONS

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Biodeteriorations are considered to be the specific type of material damages caused by different microorganisms. Among all corrosion processes, 50 per cent can be attributed, one way or another, to the exposure to microorganisms. At present, the use of biocides is found to be one of the most popular methods to combat biodeteriorations while various inhibitors and passivating agents are employed to prevent chemical corrosion. However, many compounds with antimicrobial activity are able to enhance corrosion, and chemical inhibitors affecting corrosion processes caused by a complex of biological and chemical factors. Studies have been carried out on the simultaneous effect of biocides and passivating salts used in different concentrations and combinations on corrosion of steel caused by electrochemical processes and destructing microorganisms. It has been found that biocides and passivating properties can decrease significantly the rate of corrosion. Developed compositions of biocides and passivating agents eliminate total corrosion losses several times compared to biocides or passivating agents used separately. In addition, their simultaneous application in treating recirculating water systems is environmentally beneficial due to decrease in biological concentrations which are harmful for humans and the environment. The research has been performed in the framework of ISTC Project # 119-95.

ECOLOGICAL ASPECTS OF WATER- AND HEAT-SUPPLY SYSTEM'S CORROSION

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Chemical, physical and biological pollution of natural waters leads to appreciable intensification of corrosion processes. However, this influence of mutual, as in turn, the corrosion frequently appears by the reason of significant pollution. In this connection the rational methods of anticorrosive protection should not only based on scientific representations about corrosion processes mechanism, but also correcting with allowance of a real ecological situation. In the present work this problem is considered with reference to water- and heat-supply systems corrosion.

The water-preparing equipment can be contacted with the neutral, alkaline and acid waters. Thus it's corrosion stability depending not only the water's composition, but also the thermal operating conditions: temperature, tangential (along the metal surface) and normal (on the border metal/liquid) temperature gradients. In the present work the attempt to evaluate the role of these gradients in general corrosion of the carbon steels in waters with different mineralization and copper in the carbonate water with additives of Cl^- and SO_4^{2-} -ions is undertaken. The experiments were carried out on specially constructed complex plants with nonisothermal flat plate and rotating disc heat-transfering electrode with application of express-methods non-destructive controle.

The results of investigation have shown that the occurence of the tangential temperature gradient in the system carbon steel/water is accompaning with redistribution of destruction of the metal's surface with it's concentrating in the most heated or most cold or intermediate zones of the alloy. The disposition of the preference destruction zone depends as on contents of carbon in the steel and from the water's composition and it's mineralization degree. The observed effect is stipulated by

thermogalvanic corrosion, arising because of the potantial's gradient presence in the temperature gradient's zone, and from its consequences comparative with natural corrosion about than testifies the essential increase (in 2-7 times) of summary losses of non-isothermal surface.

The influence's character of thermal conditions on the copper's corrosion in carbonate water with additives chloride and sulfate-ions depends on the activator-ion's nature. So, in carbonate-chloride mediums the action of the temperature and heat-transfer (normal temperature gradient) is being opposite: the temperature's increase stabilizes the metal (protecting it from the local damage), but the heat-transfer, opposite, promotes the pitting's corrosion development. In the presence of the sulfate-ions the temperature's increase equal as a growth of a thermal flow causes the transition from the pitting's corrosion to the ulser.

From the results of this research a database of corrosion stability of constructional materials (based on copper and iron) with allowance of medium's composition, temperature, tangential and normal temperature gradients and hydrodynamic conditions is made.

DRINKING WATER AND WATER FLOWS TREATMENT FROM HEAVY METALS

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Harmful substances are extracted from the drinking water and water flows by filtering through the Layer of sorbent. Coarse and fine filters, sand, gravel, activated coal and other things are used as sorbents. However, the desired results of water treatment from heavy metals are not achieved in all cases.

Hence, we have developed a new method of drinking water and water flows treatment from heavy metals the density of which is over than 5g/cc. It includes polluted water filtering though filters mentioned above but its distinctive peculiarity consist in water preliminary filtration through the Layer of sapropel(Official bulletin N3, Belarus State Patent, Minsk, 1994 - page 15).

Sapropel is a substances of biogenic origin.It has been Laying at the bottom of freshwater reservoirs accumulating vast number of various binding compounds and biologically active substances. Nowadays lake deposits are ready for separation, clearing, obtaining of finished product and its complex use. /M.Z. Lopotko and others, 1992/.

Natural sapropel is generally used in the Republic Belarus as material to obtain fertilizers or as a mineral supplement to forage of Livestock and recently as mud-baths in balneology.

Carbonate sapropel taken from Lakes Linje, Ozerjanskoje and Bjeloje Vitebsk and Grodno regions accordiugly has been used for drinking water and water flows treatment from heavy metals. Calcium carbonate makes up the base of its mineral part /30-80pet/. The raw materials bases of this type are situated in Grodno, Minsk and Vitebsk regions.

As determined before dry Lake sapropels absorbed differently these toxic elements from Grodno water flows in which arsenic and Lead exceed the reasonable concentration limits (RCL) /A.M. Karabanov, L.S. Boginsky, O.P. Reut, 1995/.

The new method usage has given the following results. Lake Linje sapropel absorbed molybdenum and arsenic only; the Ozeryanskoje sapropel besides molybdenum, vanadium, nickel, lead and arsenic moved away chrome (9,1pet) and metals with the density less than 5 g/cc, aluminium (60pet), strontium (46,8 pet), selenium (34,6 pet), the Beyloye sapropel besides molybdenium, vanadium, lead and arsenic absorbed zinc (100 pet), manganese (52 pet), selenium (48,5 pet), strontium (47,4 pet), aluminium (21,4 pet).

It should be noted that carbonate sapropel not only absorbed but also gave the water its heavy metals, their guantity in deposits did not exceed the reasonable concentration limits. It was dissolved in water 100 pet of vanadium and zinc, 42,8 pet of chrome, 44,2 pet of iron, 34,8 pet of nickel, 17,2 pet of lead, 6 pet of manganese and also 100 pet of titanium, 46 pet of selenium, 42,8 pet of aluminium, 10,5 pet of strontium from the Linye sapropel Vitebsk region. 12,9 pet of iron, 66 pet of zinc, 30 pet of mangenese were dissolved in water from the deposits of the Ozeryanskoye. The minimum quantity of heavy metals among which 52,9 pet of iron and 29,8 pet of chrome was found after filtering water through the Layer of the Byeloye sapropel.

Thus, the carbonate sapropel has high ion exchangeable and sorptional characteristies that serues as the grounds of principal possibility to use it as a sorbent from the drinking water and water flows not only of heavy metals but the other elements of Mendeleyev Periodic Table.

APPRECIATE OF A WATER QUALITY BEFORE REVERSE OSMOSIS DESALINATION BASED ON STUDY OF PRESSURE-UP-DRIVEN FILTRATION PROCESSES KINETICS

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One of the problems of development the reverse osmosis desalting technology is prevent the membranes surface from fouling with suspended and colloidal particles from raw water.

A possibility of updating the water demineralisation plants of power plant incorporated into "Mosenergo" Joint-Stock Company is currently under consideration. This updating may consist of the application of reverse osmosis units for partial water demineralisation followed by complete desalting in ion-exchange filters. The said technology is currently being tried and tested on a full scale at one of the "Mosenergo" thermoelectric station. A raw water of this power station is a water from Pirogovo water storage - low-turbid (SS concentration of 0.8-2.6 mg/l) and strong-coloured (colour 43-80 degrees). The difference technology of water pre-treatment were studied. They are 1.addition of a coagulating agent (aluminium sulphate) into the water to be treated, clarification in a clarification tank with suspended sludge layer, one-stage filtering; 2. addition of a cationic floculant followed by single-stage filtering; 3. addiion of a cationic floculant and two-stage filtering through anthracite and activated carbon media.

Some of above-mentioned flow sheets at certain doses of chemicals and filtration rates(for instants, at a flocculant concentration of 3 mg/l and two- stage filtration at a velocity of 5 m/h) provided colour and turbidity removal practically down to 0. At the same time, the generally accepted index SDI of water clarification quality prior to a reverse osmosis unit remained, in fact, unalterable and exceeded the value of 6.0. This situation made us turn our attention back to the principles on which the criterion for assessment of water purification degree prior to reverse osmosis units had been formed.

Physical and mathematical model of a pressure-up-driven filtration were created during work. The analysis experimental data receiving by filtration low-turbid waters through ultra- and micromembrane has demonstrated adequacy of developed models.

The developed mathematical model permits to define contribution, which introduce in change of filtration speed different processes proceeding at the pressure-up-driven filtration. It has allowed to describe a reverse osmosis desalting kinetics by microfiltration experimental data. That enables to generalise about suitability or not suitability of a water for reverse osmosis.

ION-EXCHANGE DECONTAMINATION OF WATER FROM OXYANIONS BY ORGANOMINERAL SORBENT

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Introduction

The sorbents with multifarious properties are of importance for solving of different problems connected with water decontamination.

The organomineral sorbent obtained by chemical modification of natural zeolite tuffs with using polyhexamethyleneguanidine chloride and epichlorohydrine as crosslinker can be numbered to such materials /1,2/.

The new sorbent keeps the cation-exchange properties of initial mineral matrix (natural clinoptilolite) and acquires additional properties - anion-exchange and bactericidal ones /3/. At that mechanical properties of organomineral sorbent are improved.

In this report the results of investigation of the organomineral sorbent's selectivity to different oxyanions are presented .It is evaluated the possibility of their using for complex decontamination of water.

Material and Methods

The object of study was the modified clinoptilolite of Tedsamy (Georgia) deposit. The organomineral sorbent is characterized the following ion-exchange properties: cation-exchange capacity - 1,2 meq/g, anion-exchange capacity - 0,20-0,25

meq/ml. The following two charged anions was selected: SO_4" as typical anions of surface water, and HPO_4" and CrO_4" as polluting anions. The total mineralization of investigated solutions is changed in range from 0,002 to 0,006 N.

The anions content in solution was determined by methods of the ion-chromatography and of atomic absorption (CrO_4"-ion) also.

Results and Discussion

For the quantitative characteristics of sorbent's selectivity to different ions the value of ion-exchange equilibrium coefficient was used. The values of ion-exchange equilibrium coefficient of oxyanions to Cl'-ion was obtained. This values are following, $[ml/g]^{1/2}$:

HPO_4"/Cl' -1,5; SO_4"/Cl'-3,4; CrO_4"/Cl' -4,6;

It is shown from this data, that the selectivity of new organomineral sorbent to investigated anions is increased to order:

$$HPO_4" < SO_4" < CrO_4".$$

The obtained data permitted to examine the possibility of surface water decontamination from CrO_4"-ions.

The sorption isotherm of CrO_4"- ions was obtained for drinking water, polluted by CrO_4"-ions (24 mg/l Cr). The sorption isotherm of CrO_4"-ions on new sorbent is convex and is characterized with the value of distribution coefficient near 400 in linear plot. The CrO_4"-ions sorption kinetic was investigated by method "dynamic break-through curves". It was shown that the kinetic of CrO_4" - ions sorption is described by film diffusion. The break-through time for filters of different height and for different filtration velocities have been evaluated.

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NON-REAGENT SORPTION SOFTENING IN PROCESSES OF COMPLEX PROCESSING OF MINERALIZED WATER

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Known sorption methods for pre treatment (softening) of mineralized natural and technogenic water in the processes for their demineralization find no industrial applications. This is associated with high costs of sorbents and reagent facilities and high operating costs.

Innovative technology for non-waste processing of mineralized water to produce fresh water and salt products is proposed. The technology uses for the first time non-reagent sorption process of softening feed water with calcium sulphate separation.

The proposed technology features:

- the use by a special way of modified man-made Na-A zeolites which possess a unique combination of properties providing efficient water softening; high selectivity for ions Ca (α Ca/Mg>=25), a low value of the equilibrium constant for Ca and Na ion exchange ($K^{Ca}_{Na} \cong 1$), high total capacity ($\alpha_\Sigma \cong 5$ g-equiv./l);
- sorbent regeneration in a continuous automatic mode using concentrates from the desalination stage;
- the use of the effect discovered by the authors of isothermal over saturation of inorganic solutions in ion-exchange processes.

This effect allows processing of highly concentrated solutions, efficient recovery of sorbents with no special reagents used because after recovery the concentrate over saturated by calcium sulphate decomposes spontaneously with gypsum separation.

The proposed technology for the removal of calcium eliminates the use of consumable reagents, minimizes sorbent loading. The processes of sorption and "self-regeneration" of sorbents are conducted in a continuous automatic mode.

The technology has been proven on a laboratory plant.

THE NEW METHOD OF NATURAL ZEOLITE MODIFICATION FOR USE IN WATER TREATMENT PROCESSES

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A simple method of natural zeolite (clinoptylolites) modification which enables additional functional groups selective for non-ferrous and heavy metals. The method is based on the use of temperature effects leading to irreversible immobilization in the zeolite structure, for example, Mg ions followed by its modification, in particular, by phosphorus groups. In this case the activity of the ion-exchange groups fully retains and the kinetic properties are not changed considerably.

Preliminary studies of modified zeolites (0.7 - 0.8 mg equiv./g) by the phosphate groups show that similar materials possess additional capabilities to be used in complex treatment of mineralized and technogenic water.

Natural clinoptylolites is an efficient and easily available sorption material used in deactivation, in particular, for the removal of isotopes of heavy alkali and alkali-earth metals - cesium and strontium. Modified natural zeolites are promising sorbents for complex deactivation process development.

DRINKING WATER CERTIFICATION

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The supply of the population with good quality drinking water is a problem of high priority. The quality of drinking water the consumers have been supplied with since 1939 is determined according to the standards. Standard 2874-82 is valid at present. The responsibility for the produced drinking water quality meeting the standards is imposed on the water producer.

From the very beginning the sanitary and epidemiological inspection authorities as well as GOSSTANDARD authorities have been playing the role of monitoring structures. Since 1992 GOSSTANDARD of Russia has been tackling the work concerning certification of various products including water. The work performed in this area was backed up by the Laws of the Russian Federation "Concerning the Standardization of Products" and Services" and "Concerning Standardization" as well as the Resolution by "GOSSTANDARD" of Russia and "GOSCOMSANEPIDNADZOR" of Russia of 28.0495 № 8/5 "Concerning the Creation and Putting into Practice of Drinking Water Certification, Materials, Technological Processes and Equipment Used in Domestic & Drinking Water Supply".

This Resolution and its Point 6 in Particular recommend the Municipal Economy Department of the Ministry of Civil Engineering of Russia MOSVODOKANAL Municipal Enterprise and other related organizations to carry out investigations concerning the determination of rational forms and methods for the certification of production and quality systems for the water supply enterprises.

Point 7 of the above-mentioned Resolution is dedicated to the problem of development and revision of valid standards and sanitary norms and regulations concerning the reagents, materials, coagulants, flocculants, disinfectants, sorbents, filtering materials, equipment, pipes, vessels etc. used on drinking water supply.

Unfortunately, this Resolution does not cover the raw materal sources, since the contamination of water sources makes the greatest contribution to the deterioration of drinking water quality in a number of regions of the Country.

At the same time drinking water certification in itself does not solve the problems of its quality. This certification only strengthens the control functions of State Authorities independent from the producers. Certificate of compliance received for drinking water is an additional proof of the product quality, that guarantees its safety an the State level. This is desirable and prestigious. The set of documents developed by GOSSTANDARD of Russia and establishing the Regulations concerning drinking water certification contains in fact only the organizational requirements for the procedure of getting the certificate. These documents are not connected with the production process, they do not reveal the practical realization of the ways for its preparation for certification, they do not indicate the documentation required for certification, they do not establish any

restrictions concerning individual stages of drinking water production process or the operation of treatment facilities.

Thus the technological aspect of certification is not considered.

The drinking water supplied to the inhabitants of the City of Moscow constantly meets the requirements imposed by GOST 2874-82, the source of this water is stable. The operation of the facilities, the process schedules, the quality control etc. are strictly monitored by the persons in charge of the technological process. This makes the problem of drinking water certification rather optimistic for the Muscovites. Nethertheless the realization of this problem is curbed due to the absence of the requirements concerning both the list of documents to be applied for sanitary certification (compliance certification) and the content of these documents.

PROVISION OF MEASUREMENT UNIFORMITY FOR DRINKING WATER QUALITY CONTROL. NORMATIVE BASE IMPROVEMENT

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The law of the Russian Federation "Concerning the Provision of measurements uniformity" adopted in 1993 is of paramount importance for drinking water quality control. According to this law "the measurements uniformity" should be understood as "... the condition of measurements when their results are expressed in legalised units of values and the measurement errors are within the established limits with the preset confidence level".

That means that for the realisation of the requirements concerning the provision of the uniformity of measurements there may be compared analytical results obtained by different laboratories at different time, by various methods and for various objects.

While monitoring the drinking water production process, laboratories receive information including dozens of various parameters monitored in water samples taken at various points of the system. Only the analytical results obtained with preset confidence coefficient and within permissible error standards may be comparable (taking into account the task set).

In some other cases the data comparability may be incorrect. Consequently, the work of all laboratories providing drinking water monitoring should be rearranged with the aim of provision of guaranteed reliable evaluation of its quality.

The criteria for metrological provision of measurements are as follows:

- application of standard (certified) methods for performing of measurements

(determinations) of all drinking water quality indices (according to GOST2874-82);

- application of calibrated measuring devices, instruments, laboratory measuring glass-ware, auxiliary equipment, etc.;

- establishing and continuous operation of the system for internal and external control of the obtained results reliability;

- availability (at the laboratory} of normative documentation establishing the requirements for the controlled objects, measurement methods, etc.;

- availability (at the laboratory) of the professionals in the field of water analysis;

- provision of climatic conditions for analysis performance (temperature,

absence of noise, vibrations, magnetic fields and other external interfering factors).

12 laboratories belonging to Mosvodokanal State enterprise were certified just according to these criteria. The control provided by these laboratories cover all the aspects of the water supply of the City of Moscow. These laboratories provide the monitoring of water sources, drinking water production process, drinking water at water treatment plants, drinking water

in distribution systems of the City, etc.

It should be mentioned that the preparation for the certification of all the laboratories as well as their actual certification resulted in the integration of the system providing measurements uniformity into the structure of Moscow drinking water control.

At present determination results are expressed not only in legalised units (as always) but with the confidence coefficient of p= 0.95 as well, indicating the determination error which as a rule is constantly lower than the normative values established in accordance with GOST 27384-87.

Henceforth the information received by Mosvodokanal laboratories is quite reliable.

CRITERIA FOR EVALUATION OF CONSUMER PROPERTIES OF WATER TREATMENT UNITS FOR DRINKING USE

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Today, the necessity for complementary treatment of tap water is apparent even for non-specialists. this problem is solved by units for additional purification and disinfection, named "filters" in everyday life.

At present, there are no universally recognized criteria to evaluate effectiveness of these filters and to determine feasibility of their use in various cases. Most published recommendations have one-sided and unjustifiably categorical character. They have in common a meagre random list of polluting substances which were used in testing the filters, "easy to do" methods of this testing and, what is most important, the recommendations are in no way connected with specific qualities of concrete water to be treated, which will be influent to a given filter.

Correct choice of a filter by the consumer is impossible without objective information on contents and specific properties of influent water.

Herein a new systems approach in proposed to evaluate consumer properties for filters. Feasibility of using this or that filter is strictly connected with specific properties of influent water, as every filter may be effectively oriented only upon water of definite quality.

Two forms of consumer charts have been worked out: Consumer Chart of water and, corresponding to it, Consumer Chart of a filter. The former represents a code, i.e. a limited set of symbols, which represent results of investigation on the influent, most often-tap water, for different quality parameters and hundreds of individual polluting substances. The latter reflects in a coded way results of special tests of a given filter and data, characterizing its operational characteristics, Coincidence of both charts enables a consumer to judge for himself whether a filter is in principle suitable for purification of "its" water or if it has consumer advantages.

the Test Center has also worked out a list of parameters for water being treated and methods of testing filters for drawing Consumer Charts, covering most hazardous classes of pollutants, as well as principles of coding that voluminous information.

Presented in Consumer Charts code of individual organic polluting substances in water takes in consideration their nature, skeleton structure of their molecules, presence of various functional groups, and relationship with different chemical classes.

Codes of inorganic water components reflect their cation-anionic composition, valency, presence of mentioned water impurities in ionic form or in organic molecules, etc. Similar systems approach with working out design formulas was adopted for all types of other, non-chemical individual pollutants of water and for integral quality parameters.

Thus, information on water was concentrated into a line and took a convenient form for a consumer. Moreover, the Consumer Chart is formed so that any increase in number of controlled parameters will lead only to its greater correctness, but not to an increase in its size. As to indexes of Consumer Codes for filters, instead of polluting substances content or of integral or other water quality parameters, there are shown maximum possible parameter values for influent water, which a given filter is capable to purify to safe level for all stated parameters.

Code assigned to a water treatment unit, together with the tap water code, will help a potential consumer to quickly evaluate whether technical possibilities of a given filter correspond to the character of water to be treated.

the same Consumer Charts are used to evaluate water treatment units of greater capacity used for raw water: units for cottages, summer houses and shift workmen's settlements. There the approach is the same in principle: lack of knowledge of influent water quality characteristics will lead wither to unreasonable increase in cost of treatment, or to "break through" of polluting substances into drinking water.

NEW APPROACH TO PROBLEM OF DEVELOPING WATER QUALITY STANDARDS

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Sanitary and hygienic situation in provision of safe water to population cannot be improved without improving the basis of standards.

The effectiveness of both "inlet control" and a more profound control of drinking water quality presupposes the availability of a correct list of controlled quality parameters. The list of Maximum Allowable Concentrations of Harmful Substances in Water Bodies Used for Domestic and Public Purposes (SANPIN 4630-88) enforced in Russia, as well as current international documents regulating drinking water quality, in many aspects disagree with modern chemical and ecological ideas, take no consideration of the possibilities of modern ana-

lytical chemistry and, in fact, are devoid of any conception.

Main defect of the employed lists is their continuos mechanical increase in number of controlled parameters, having as a rule, random and non-systematic character.

there is an impression that an attempt is made to enumerate in alphabetical order millions of possible toxic organic compounds, including their isomers.

No account is taken of sharp difference in toxicity of inorganic substances present in water in different forms: as simple or complex ions or as part of an organic molecule, or even just in a simple ionic form but having different valencies, which presupposes very different effect on human organism.

In this connection the Test Center of the Institute has worked out principles of drawing a list of controlled parameters in drinking water, as well as in any water body. The principles are based on ideas adopted in international classification of inventions and allow to avoid the enumerated defects.

The principle of compiling the List has been worked out for the first time, and it differs from all previously used analogous. It enables to make the Lest more precise and add new substances to it without destroying its inner structure as sanitary and hygienic conceptions make progress, new norms are set up, and chemical and analytical basis is developed.

The recommended List includes individual chemical substances which may be present in tap water in the form indicated, can be identified by modern analytical methods and for which quality standards have been established nowadays.

The List is drawn up with divisions (parts) in accordance with structure of organic and inorganic compounds. Every subdivision is and expansion of corresponding division. Within a subdivision substances are situated in the order of numerical values of heir norms (MAC).

The largest value of the norms for substances in a given group is assigned to the group. In case when a compound is detected in water but is not on the Lest, the value of the norm for it should be that of the group of substances to which the compound belongs by its structure.

A really existing single and mutually dependent system: raw water - drinking water - waste water - treated waste water - raw water to day is no joined up by a package of standards having a single logic and ensure with an effective mechanism for their compliance.

The worked out approach to form a List of obligatorily controlled substances suitable for any water bodies is a first step to create a unified vision of water ecology problem in practically all its aspects - legal, economic, hygienic, sanitary - technological, control and analytical, etc.

COMPLEX TREATMENT OF NATURAL AND RINSE WATERS FOR THE PRODUCTION OF PORTABLE WATER

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The aim of this work is to develop complex technology for the treatment of sea and rinse waters of electroplating industry for the production of portable water and mineral resources. Complex treatment employs basic principles of waste-free production, self-provision with reagents and ecological cleanliness. Filtration, fractional precipitation, coprecipitation and electroflotation methods are used for the preliminary treatment of water. The main membrane methods used are electrodialysis, membrane electrolysis and reverse osmosis.

The complex treatment of sea water is based on the method of fractional precipitation, membrane and electrochemical separation methods of treatment, desalination and concentration of solutions. The given scheme allows to obtain more than 80% of desalinated water relative to the initial, calcium carbonate with coprecipitated impurities and salts of humic and fulvic acids as fertilizer for acidic soils, mixture of $CaCO_3$ and $Mg(OH)_2$ for the production of building materials, pure MgO for refractory materials production and concentrated solutions of hydrochloric acid and alkali. Preliminary estimations showed that the cost of these products substantially covers energy and depreciation cost of their production.

The complex technology for the treatment of rinse waters of the electroplating industry uses electroflotation method with pH correction for the removal of organic impurities, salts of hardness of water and non-ferrous metals, and electrodialysis method for demineralization and concentration of solutions. In this case more than 98% of demineralized water, alkali and electrolyte solution were obtained. The products obtained provided for the profit of the total production.

A NEW APPROACH IN THE TECHNOLOGY OF PRODUCTION AND APPLICATION OF ALUMOSILICATE COAGULANTS

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The problem of rational application of nepheline-by-product in the apatite production still now stays actual. One of the perspective directions is acid treatment of nepheline. The technologies of acid treatment of nepheline, which are known allows to produce coagulants, silica and alum. Under treatment nepheline with diluted acids the solution, which called alumosilicate coagulant (ASC) is obtaining. Combining the best properties of water treatment reagents- aluminium sulphate and active silica the ASC is the effective universal flocculating agent and coagulant. However, the disadvantage of this coagulant is low stability, since in short time (1-7 days) ASC unreversible became gel.

The aim of the present work is creation of coagulant with increased stability (ASC-M) , and developing the methods of its application in the technology treatment of waste water of different nature and composition.

On the base of comprehensive investigation of gelation inhibition effect of various organic and inorganic additives of different nature it was established that addition of the trace quantities of polyelectrolytes essentially increase the time of stability of ASC (till to 3-4 month). The dried ASC-M keeps all properties of origin product more then 1 year.

The complete investigations of flocculating and coagulating action of ASC-M using the model and real waste waters, containing petroleum, organic solvents, fats, proteins or heavy metal salts have show high purification efficiency. Partially, the efficiency of petroleum wastes removing is equal 85%, and Th, Np and Sr- ions are 66, 97 and 91 %, accordingly.

The change the ratio silica/alum in ASC-M up to optimal magnitude allow to decrease the specific expense of ASC-M comparing to aluminium sulphate on 20-50 % and increase, at the same time, the sedimentation velocity of the formed particles.

It was shown high efficiency of ASC-N as structuring and drying agent for water slugs. It indicates the perspectivity of application of ASC-M for thickening of water slugs.

CHARACTERISTICS OF HYGIENIC EFFICIENCY OF INDIVIDUAL DRINKING WATER DISINFECTION AND TREATMENT DEVICES

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Lately individual portable devices for obtaining good-quality drinking water from nonequipped freshwater sources are becoming more and more widely used. These devices are completely autonomous, take into consideration ergonomic capabilities of man, are of a minimal size and weight, are always ready for use and provide for disinfected and treated water within a minimal period of time.

We participated in the development of a number of such individual portable devices made in the form of polymer tubes ("Rodnik", "Topaz-01", "BIP-1"), the basis for functioning of which is a combined principle of action (physical and chemical processes). The mentioned devices have passed certificate tests and are being produced at present. The basic model of the device "Rodnik" which won the premium of the Council of Ministers in 1987 and which later was developed into "Topaz-01"and "BIP-1" has become more portable and is equipped now with new additional filtration materials.

Hygienic assessment of the possibility of migration of toxic chemicals from the complex of construction materials filters has not detected any negative changes in the quality of water treated by individual portable devices according to bioassays on hydrobionts and physico-chemical studies results.

Assessment of the efficiency of of functioning of individual water treatment devices was made in large-scale resource tests using native river water (the Moscva river) with different kinds of artificially administered additional biological (bacteria, viruses, parasitic diseases pathogens) and chemical (metals, organic substances) contamination with the aim to form most frequently observed deviations from standard values according to chemical parameters, and according to biological parameters - of maximally aggravated conditions which can practically be observed only in special, exclusive cases. Such a model of experimental studies makes it possible to give universal assessment of efficiency of water treatment.

It has been shown that , small as they are ("Ropdnik"- 200 x 14 mm, "Topaz-01"- 180 x 12 mm, "BIP-1"- 135 x 15 mm) devices can efficiently

purify and make a guaranteed decontamination of significant amounts of water taken from nonequipped freshwater sources: "Rodnik" and "Topaz-01"- 25-30 l, "BIP-1"- up to 10 l, providing for a "comfortable"for man flow rate (70-100 ml/min) (Table 1).

Table 1.

Efficiency of Decontamination and Treatment of Water by Individual Devices.

Parameters studied	Hygienic standard	Level of contamination of initial water	Efficiency of decontamination and treatment of water, %		
			Rodnik	BIP - 1	Topaz01
BACTERIOLOGICAL:					
- E.coli, cells/l	<3	10^6	100	100	100
- TMC, cells/ml	<100	10^6	99.99	99.99	99.99
- *Pseudomonas aeruginosa*, cells/l	0	10^2	100	100	100
- Salmonellae, cells/l	0	10^2	100	100	100
VIROLOGICAL:					
- Coli-phages MS_2, PFU/l	0	10^6	100	100	100
- poliomyelitis virus, lg CTD_{50}/ml	0	2-3	100	100	100
PARASITOLOGICAL:					
- *Lamblia* cysts, u/l	0	10^1	100	100	100
-Helminths, u/l	0	10^1	100	100	100
- Cryptosporidia oocysts, u/l	0	10^1	100	100	100
TOXICOLOGICAL:					
- lead, %	0.01	0.02	85	78	81
- phenol, %	0.001	0.005	90	90	90
- benz(a)pyrene, %	0.01	0.02	85	80	83
ORGANOLEPTIC:					
- colour, %	20	40	50	50	50

High efficiency of decontamination of initial water using the most portable device "BIP-1"made as a pen can cope practically with any levels of microbic contamination (from 10^5 to 10^{15} micr.bodies/l of water), which has been confirmed also by certificate tests made in France and SAR.

EXPERIENCES IN WATER PURIFICATION AND DISINFECTION WITH UV-LIGHT

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There are more than 300 millions of tons per year of terpenes, organics compounds emitted by plants, especially by conifer trees. The surface of the Earth would be covered by a thick layer of responsible compounds and materials. But the light of the sun and the oxygen of the atmosphere are treating water, air and soil all over the time until today and in the future.

One of the most progressive and innovative technologies for the treatment of the water- also for treating polluted air and soil- is the photo initiated oxidation of the pollutants by light and oxygen. Simulating the natural cleaning process mentioned above this technology needs an " artificial sun " and an oxygen source.

The "Photo-initiated UV-oxidation"- PUV^R - developed by BiosQuant GmbH, causes the oxidative decomposition of all organic and a number of inorganic compounds down to a concentration range less than parts per trillion (ppt). It is applicable to each kind of contaminated water like drinking, ground, processing, waste and further types of water. Complete "on-site" destruction of toxic and other contaminated organics is guaranteed without any disposal problems and to meet every purification requirements. BiosQuant GmbH has gained experience in treating aliphatic and aromatic hydrocarbons, halogenated derivatives, alcoholes, ketones, ethers etc. The BiosQuant GmbH photo reactors product series BioOx^R (with any desired accessory components) are designed for different flow rates from 0,1 m^3/h up to 20 m^3/h and more. They are available as installed indoor equipment and transportable container mounted and mobile trailer mounted units.

A second field of application of UV-radiation in water (air) treatment is the disinfection of water (air) contaminated by bacteria, fungi, viruses and the permanent forms of microbes. The 254-nm-irradiation of special low-pressure mercury-doped lamps generates chemical destruction in cell compartments like the DNA, proteins, membranes. This causes the life inhibition of the micro-organisms at a rate of 99,99% and more. By an irradiation power of

400 J/m^2 at above mentioned wavelength all pathogenic bacteria, fungi and viruses, especially those of the type of legionella and pseudomonae will be killed for disinfection of water of different type and use like drinking, bathing, process water etc..

BiosQuant GmbH water disinfectors of the BioDes^R product series are available for a throughput from 0,120 m^3/h to 800 m^3/h and more. The disinfection units will be installed at a central position of the water providing system or at the user point, useful for cold or warm water. They are monitored by special UV radiation detectors and thus the disinfecting action is reliable and safe assured. UV disinfectors with flow rate up to 2,70 m^3/h can operate under alternative power supplies such as solar cell, electric generators or battery.

DEVELOPMENT OF THE BIOLOGICAL METHOD FOR PROTECTION OF RECIRCULATING WATER SYSTEMS AGAINST BIOCORROSION

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Vital activity of microorganisms is considered to be one of main factors causing corrosion of recirculating water systems. At present, chemical biocede-based methods are widely used in treatment of such equipment. However, application of biocides leads, one way or another, to contamination of the environment, as biocides themselves are harmful to humans and animals. In this context, the development of biological methods for protection against biocorrosion is becoming of great importance. The possibility to use antagonistic properties of bacteria in the development of the method for protection of steel from corrosion was studied. Destructing microorganisms and their potential antagonists were simultaneously cultivated on agar medium. Six strains which produced metabolites inhibiting the growth of destructing bacteria were obtained. It has been found that the rate of biocorrosion of steel was 50-80% less after introduction of antagonists into a system. Besides, the passivating effect of bacterial and yeast cells which produce no corrosive effect on steel was studied. It has been found that the introduction of these microorganisms inhibits corrosion significantly. The inhibiting effect of these microorganisms is likely due to a passivating superficial film formed on metal. Such protective effect increases considerably if microorganisms are released into a system some hours before the introduction of destructing bacteria. The research has been performed in the framework of ISTC Project # 119-95.

NONCOMMON SOURCES OF POTABLE WATER NEAR COASTAL CITIES. SUBMARINE SPRINGS OF FRESH WATER AT THE CRIMEA SHELF

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The main idea of our investigation is searching of submarine springs of potable water at the Crimea shelf, specially near Sevastopol district. The geochemical analysis of Crimea mountains structure had predicted the existence of groudwater discharge at the Black sea aquatory near Crimea and estimated the submarine fresh water flux in the most anticipated region from Simeiz to Armiansk as 83.2*10^6 m^3/year. If only 1/100 part of this flux will be captured and used as source of potable water - it will be possible to supply by fresh water at least the population of coastal Crimea cities.

The predicted flux at the most intersting region near cape Aya is rather smaller, about 5*10^6 m^3/year, but according to the geological estimations the submarine flux here should be concentrated in the local springs and is not dispersed by the slow penetration through porous bottom as it takes place in Baltic and Black Sea near Varna. Later the several submarine springs were reveled in the grottos of the Aya cape with the water salinity about 4.8‰ in the best case.

We present here our first results in the identification of submarine fresh water springs at the Crimea shelf. The first hydrochemical task of our work was the searching and approving of reliable and easy operable method for the distinguishing of submarine fresh and ambient waters. Using the difference in the salinity and silica concentrations in sea and spring waters we proved in 1993 the existence of submarine springs (surface salinity 10-11‰) in the grottos at the Aya cape and estimated the fresh water output of one of them as 6500 m^3/day. Mathematic examination of 1993-data has shown good correlation between salinity and silica concentration, later parameter we have used in

1993-1995 as hydrochemical probe in searching of submarine water springs at Crimea shelf.

In 1995 the hydrochemical investigations were made simultaneously with hydrology-hydrooptical measurements, later show the more transparency of brackish surface water near the cape Aya. The attenuation coefficient for 0.5 m brackish surface layer is 0.08-0.10 m^{-1}, in comparison with the ambient value 0.20 m^{-1} for the investigated area.

So, the complex hydrochemical and hydrology-hydrooptical investigations in 1995 have proved the existence of the submarine fresh water springs, estimated by us, is about 30000 m^3/day.

The fine structure of silica distribution (60 samples were taken not far then 60 m from the western wall) in the discharge region had shown strong current of brackish water with the terminal in the center of the western wall. Later we have discovered there the small grotto with the discharge power about 10000 m^3/day and surface water salinity 10‰, before it we have thought that the most powerful (6500 m^3/day) spring of fresh water is situated in the alredy mentioned biggest (40 m in long) grotto of the Aya cape.

In autumn 1995 we have widened the region of searches and habe investigated the silica distribution near the Aya cape western wall in the area 1.5*1.5 km and have discovered two areas with the incresed silica concentrations in 0.5-1 km from the wall. We hope that these areas of high silica concentrations are connected with the submarine springs of fresh water in the bottom of the shelf.

SNOW AND SMALL WATER FLOWS AS SOURCES OF WATER SUPPLY THE BORINGS

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Usually natural fresh water is used for water supply of borings. Resources of subsurface fresh water particularly on oil and gas field of West Siberia are limited. So the main sources of the borings water-supply are rivers and lakes.

Rivers and lakes are the areals of submarine biocenosis and the most important regulators of climatic, biological, geomorphological and other natural processes. Arrangement of borings near the rivers and lakes may disturb the ecological balance and diminish fish reserves. Besides, rivers and lakes in the northern part of the West - Siberia often freeze and their water quality is not satisfactory. In these conditions it is reasonable to use snow which resources are very large. On the major part of Siberia the snow cover lies about 7 - 9 months and its thickness is about 0,2 - 0,5 meters (up to 2 meters and more in the low parts of relief and in a wind shadow).

The volume of water use in boring of prospecting holes of 3500 meters depth violates from 3 to 11 cubic tons. The equivalent snow volume is not more than 30 thousand cubic tons. Snow will occupy the area of about 150 x 200 meters at its thickness of 1 meter. To collect so much snow is not difficult technically. But the problem is in delivering snow to the boring and its thawing in winter, protection of snow from the intensive thawing and working out economic devices of collecting and delay of melt water in summer.

For collecting and delivering snow to the boring there can be used snow-clearing machines and snow-retention devices (railings, shields, snow rollers, etc.). In Siberian North where the relief has erosional and depressional forms, the problem of collecting snow may be considered as the usage of relief lowerings for possible storage of snow. Snow thawing takes place in standard 25 cubic meters reservoirs by usual means for water heating (with increasing of their capacity). Gas-burners use is possible. Protection of snow from the intensive summer thawing is carried out by the removable heat-isolating and reflecting light covers. For the retaining melt water in the relief lowerings the place of drain is damed. For this purpose a collapsible dam is worked out. It is made of a light material, for example tarpaulin, fastened on the wooden uprights. The dam consists of two flat parts being joined by hinges - flutbett and floating shield.

The dam (the shield lies on the flutbett) is put on the bottom in the direction opposite to the flow by the sides hinge free. Under the influence of the flow the shield comes to the surface turning to 90 degrees (the angle is fixed by special stop) and taking the vertical position. Using such dams there can be formed small storage of water in the bed of every small water flow not necessarily of snow origin. After finishing the boring works water from the storage is being let out and the dam easily

INTENSIFICATION OF OPERATING SETTLING TANKS AND SOLIDS CONTACT CLARIFIERS IN RAW WATER TREATMENT PROCESSES

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At present, a number of techniques to intensity operation of first-stage treatment units, i. e. settling tanks and solids contact clarifiers, have been developed.

The most complicated problem appears when cold colored water of low turbidity is treated. In these conditions a combination of contact flocculation and lamella settling is possible.

In flocculation basins of settling tanks it is feasible in this case to use contact flocculation with coarse-grained fractions of floating medium or foam plastic (10-30 mm size). For a number of reasons, gravel medium was found to be unsuitable.

It is also possible to combine this method with the use of upper parts of lamella elements, increasing the size of cells to 100 mm.

In horizontal settling tanks lamella blocks are set up over the area, partially or all over.

In vertical settling tanks intensification is ensured practically in the same way as in flocculation basins of horizontal settling tanks, however the lamella elements ensure intensification of both flocculation and sedimentation processes.

In suspended solids contact clarifiers it is feasible to place the contact medium in the sludge blanket with lamella elements above it. Then in the sludge thickening zone an effective result is obtained when the lamella elements are placed in two layers (above and below sludge ports) to serve for clarification and sludge thickening respectively.

In many other instances, contact flocculation can be substituted by recirculation of sludge by ejection, the recirculators being placed in the lower zone of settling tanks and clarifiers.

Lamella elements are made of polyethylene film, using ready-made constrictions, produced by extruded additive method.

OZONE GENERATORS BASED ON PULSE CORONA DISCHARGE

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Pulsed corona discharge is one of the most attractive kinds of electric discharges for ozone generation, the energy cost of ozone produced in such discharge can be lower than in other discharge types.

Physical and chemical processes in a pulsed corona discharge, which lead to ozone synthesis, have some peculiarities in comparison with widespread barrier (silent) discharge. The differences are in processes of feed gas heating, gas - wall heat exchange as well as physical and chemical processes of ozone synthesis, its interaction with wall surfaces. But the most essential difference is that the energy cost of ozone produced in a more powerful regime is lower than under low energy input. This phenomenon is specific only for corona discharge and not for barrier discharge. It is supposedly connected with the fact that the ozone produced is destroyed mainly on the surface of chamber walls (it is known that in a barrier discharge ozone is destroyed mainly in the gas volume in a discharge zone).

Due to these specific features extremely low energy expenditures of ozone synthesis are achieved in pulse corona discharge at room (not cryogenic) temperatures.

Since late eighties investigations of the processes and development of devices for ozone generation based on pulse corona discharge have been carried out in our enterprise. We have also been developing systems for direct purification of exhaust industrial gases (including the deodorization of ventilating exhaust gases of sewage treatment plants) and waters by pulse corona discharge.

The designing of the ozone generators is developing in two constructionally different directions:

- generators for production of low and middle concentration ozone from dry air or oxygen mainly for processing drinking water and for treatment of sewage water;
- generators for production of high concentration ozone from oxygen (high concentration ozone is necessary, for example, for pulp bleaching).

In the simplest variant the discharge chamber of an ozone generator of the first type is coaxial tube electrodes. High voltage pulses are applied to a coronning (inner) electrode. The duration of these pulses maintains the current flow of the corona discharge and prevents the transformation of the corona discharge into a spark.

Energy expenditures on ozone production from dry air (oxygen) in such a system are 10 kW*h per 1 kg of ozone at ozone concentration 2 % (4%) weight and at the cooling water temperature 20°C.

Some ozone generators based on pulsed corona discharge with productivity from 50 to 300 g/h have been manufactured and supplied to customers by our enterprise. Lately a generator with productivity 2,5 kg/h has been produced and is being tested at the moment.

Ozone generators based on pulsed corona discharge have the following advantages:

- extremely high energy efficiency (low energy cost of ozone production);
- absence of dielectric materials in the discharge gap;
- small pressure loss;
- simplicity in construction, ease in fabrication, and consequently, cheaper ozone generators (low investment costs).

The second type of an ozone generator based on pulsed corona discharge is designed to produce ozone of high concentration, with oxygen as a feed gas. At present the investigation of the elements of ozone generator with productivity up to 100 g/h are completed. Ozone generation system with productivity 1,5 kg/h is being developed.

The concentration of the ozone produced is ranges from 60 to 150 g/m^3. Energy expenditures on ozone production in a such system are from 7 to 14 kW*h per 1 kg of ozone respectively (taking into account the efficiency of pulse power supply unit).

FACTORY BUILT TREATMENT UNITS

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At present at Russia and the UIS they use package water treatment units STRUYA, VLAGA and DEFERRIT designed to putify row surface and ground water, removing suspended, colloidal and dissolved substances (iron, manganese, hardness salts, fluoride etc.).

Iron removal units DEFERRIT find widest application. Their capacity is up to 10,000 m^3/d. Experience gained by their operation allows to ensure their total automation and in a number of case operation without pumps. The VLAGA units are being totally reconstructed. They are designed primarily to treat raw surface water with capacities up to 10,000 m^3/d.

In these units lamella elements are used at didderent treatment stages (flocullation, sedimentation, sludge thickening) and are made from light polyethylene film by extructed additive method.

The units also ensure recirculation og sludge by ejection, as a means of flocullation in combination with lamella elements, and have metall-polymer underdrains with alternate scour in rapid filters.

New construction of lamella elements using polyethylenefilm instead of tube modules is worked out for modernized STRUYA units, in which recirculation of sludge by ejection is also used at the stages of flocullation and sedimentation.

Some parameters of the units are shown in Tables 1 and 2.

Table 1. DEFERRIT unit.

Capacity, m^3/d	100-1600
Power consumed, kWt	4.6-30
Overall dimensiones:	
height, m	3.4-3.7
floor area, sq.m	6.5-50
mass, ton	3-13

Note: parameters for units of 3.2-10 thousand m^3/d are not shown in the table.

Table 2.
SRRUYA-M and VLAGA units

Parameters	STRUYA	VLAGA
Capacity, m^3/d	100-800	1600-10000
Power consumed, kWt	10-20	25-65
Overall dimensions:		
height, m	3.5-4.5	3.8
floor area, sq.m	25-37.5	600-950
mass, ton	3-14.7	24-90
Operating mode	pressure	by gravity
Number of people supplied	50-10000	10000-50000

THE SCIENTIFIC AND TECHNOLOGICAL ASPECTS OF THE USE OF POLYMERIC SORBENTS FOR POTABLE WATER QUALITY IMPROVEMENT

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The increasing anthropotechnogenic contamination of natural waters on the one hand and the lack of water preparation technologies allowing to withdraw such impurities on the other hand, require the development of new and improvement of the existing methods of potable water preparation, its quality ensuring people's health.

Moreover, the traditional water preparation technologies using chlorination result in the formation of halogen containing organic compounds (HCC) in water, their toxic, carcinogenic and mutagenetic effect on living organisms being greater than of initial organic impurities. The application of quite new water preparation technologies having no shortcomings of the existing ones entails great difficulties, requires much time as well as cost. In this connection the development of measures aimed at reducing HCC concentration in potable water is undoubtedly urgent.

The sorption methods of HCC withdrawal which employ easily and quantitatively regenerating polymeric synthetic sorbents with inert surface and developed structure of pores arouse great interest at present.

The possibilities of sorptional withdrawal of chloroform (the main component of HCC) from water solution by means of polymeric sorbents of "polysorb" and "porolasses" classes differing in structure and specific surface have been studied. Absorption in equilibrium over a wide range of chloroform concentrations under dynamic and static conditions has been investigated into. On the respective linearizing coordinates experimental adsorption isotherms have been analyzed on the bases of monomolecular adsorption theory concepts by Langmure's equation and polymolecular adsorption theory by BET equation modified for the adsorption from solution as well as by Freundlich's experimental equation. The main absorption parameters have been calculated, the degrees of chloroform withdrawal from different concentration water solutions have been determined as well.

On the basis of adsorption kinetics studies a conclusion about the mechanism of chloroform diffusion in the sorbents under investigation has been drawn.

Apart from being significant by themselves the obtained dynamic and kinetic data about chloroform sorption permit to choose the sorbents combining adsorption selectivity and maximum capacitance to chloroform with its high rate and degree of extraction from the purified water.

The results presented in the paper allow not only to recommend the analyzed sorbents to the used for potable water final purification but also to model the main technological regimes for the real conditions of water preparation plants obtaining potable water that would meet EEC standards (lower than 1 mcg/dm^3).

THE PROBLEMS OF NATURAL WATER CONDITIONING AND THE WAYS ITS SOLVING AT PRESENT STAGE

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Powerful pollution of water sources, that have global character east time to situation, when selfcleaning ability many of them is settled. Result of the breach normal function nature water ecosystem is sharp deterioration of quality, used for water supply to population. Absence of scientific well-founded forecast about changing condition of water object led to such situation, when many stations of water cleaning today use technologic progress, which correspond to quality water 20-30-years standing, so actually can't provide with needed level conditioning of drinking water.

For have a look for way out of created critical situation is needed to create flexible modern technological progress, materials, reagents, structures and equipment.

Our institute is leading organisation in the field of water supply in Ukraine and diposes large theoretical and practical foundation for solving the problem of water conditioning. We developed the technologies for removal of iron, manganese and fluorine from underground water, coagulation, ozonation, slow filtration, removing phytoplankton - for surface water and also complex technology for the cleaning water of north oilgas-bearing areas, that contained many unfavourable components

(colouring, metalorganic complexes of iron and manganese, ions of ammonium, oil products and methane).

For the effective and rapid realisation of indicated technologies we developed special equipment - technological bloc-module. Module arrangement water cleaning structures make it possible to organize needed scheme cleaning in the place and reduce to a minimum expenditure for assembly and put in order equipment. According the real needs stations water cleaning we developed three types equipment different productivity - from 5 to 100 m^3/day - equipment fully collect in the plant and can be accommodated in the special wagon, from 100 to 3000 m^3/day - fully plant reading and can be accommodated out of doors or in the building, from 5000 to 40000 m^3/day - collect in the place of exploitation from separate units and elements.

Present equipment can be used in different technological schemes with apply special additional changeable.

In the world practice of water treatment individual device for cleaning and finish cleaning water acquire most development. It is not only economic, but effective remedy because it is possible to get high- quality water directly "near tap". In this way, we developed individual water cleaning installation (EVU) with productivity 20 l/hour (in metallic and plastic execution) and family domestic filters for finish cleaning underground and surface waters.

All our technologies and equipment developed from real condition of function system of water leaning and that's why can be easily inculcate in any object.

DEPTH WATER PURIFICAITION FROM OXYGEN BY REDOX-SORBENTS

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Traditional methods of removal of dissolved oxygen from water do not satisfy modern energy, electronical and radiotechnical branches of industry because of the both depth of oxygenlessing and degree of water pollution by salt impurities. It is possible on principal the depth removal of oxygen from dionized water using redoxfiltres. Possibilities and means for the solution of this problem were considerable extended assosiate with synthesis of various chemical active polimeric sorbents and coals.

The purpose of present work is the choice of ecologically and economically expedient sorption system of depth and continuous purification of the water from oxygen (to level of 30 mcg/1) without bringing in secondary impurities and pollutants.

The known in industry practice kinds of redox-sorbents were taken for the investigation. The follow methods of oxygen removal from the high-purity water depending on concreat conditions of production considering the whole complex of carried out investigations are recomended.

The redox-anionite in the reductive form is recomended as sorbent either for a short-term sorption under intensive water feed to filter or for a long time work of filter under low feed rate. The cycle may be repeately recur after regeneration by the reductant solution. This method is secure from the standpoint of water oxidizability and carring of impurities of metal ions to filtrate.

The system of sequential filters, the first of which is serving as a main oxydunt adsorbent, is recomended for high oxygen concentrations and great feed rates. The first filter fills in a metal bearing redoxite, the second contains redox-anionite in reductive form. The system of these filters by more great feed rates of water with initial content of oxygen 7-9 mg/l is capable to give in a one run period in 5 time more water with residual concentration of O_2 under 30 mg/l, than one redox-anionite filter. The cycle may be repeat after regeneration of filters by solutions of reductants.

More over, it is possible to carry out reagentless electrochemical regeneration. The volume of oxygenless water for the system of these filters is essentially higher. The metal ions are capable to be reduce and remain in the redox-anionite as a oxygen reduction catalyst, therefore undersiable possible getting metal ions traces to water is prevented.

The preliminary removal of gases-oxidants by argon or nitrogen bubbling of water before its feed to redox-filters according to aforesaid methods is also worth while. It is most retionally to place redox-filters at the final water purification after cationite and anionite filters and before filter of the mixed action.

NEW TECHNOLOGICAL METHODS AND APPARATES FOR LARGE SCALE ELECTRON-BEAM TREATMENT OF WASTEWATER AND DRINKWATER

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Up to date a lot of various schemes and methods for the teratment of wastewater and drinkwater have been suggested in many countries. Among them, the radiational technology is one of the most effective and universal (1-3) since it makes it possible to clean up, sterilize, desodorize and decolorize with a high efficiency huge volumes of wastewaters from various manufactures (3, 5) including azo dyes, oil chemistry, cellulose paper, chemical and municipal wastewaters. In these cases conventional schemes and methods require, as a rule, an instalment of separate technological blocks and apparates for each type of contaminations (say, such as synthetic detergents, wastewater of oil industry, phenols etc.), the fact which rises the cost of the technological chains and equipment essentially. In sharp contrast to the above, radiational method - in case of properly chosen technology- makes it possible, in principle, to neutralize simultaneously many different types of wastewater in a universal module (or, mostly in a few reaction modulas). Unfortunately, up to date the radiational technologies of wastewater treatment did not find any wide implementation (though the pilot facilities have been constructed in many countries) due to some general reasons:

- a high cost of modern industrial accelerators (in between $ 500,000 and 1 million); a necessity in thick radiational protection (of walls, ceiling etc.) of technological space;

- complex problems of unification and classification of exhaustes and radiational cleanup processes.

In the present talk a new view on radiational technologies for wastewater and drinkwater treatment is suggested.

In particular, we discuss the following improvement in the technology:

- an original construction of high current electron accelerator with cylindrical geometry and extended cathode (so called high power radial diod) blocked up with reaction chamber of coaxial form in one unit. The construction is self-shielded and does not offer any serious radiational background in outer space (4);

- new construction of ozone (or ozone-air flow) generator separated from an unified installation (as is in convertional apparates (3)), supplied with a separated high current low voltage (~300 kV) electron accelerator of the above-mentioned type, that makes it possible to built a new very powerful generator of ozone-air mixture and thereby to enlarge productivity of the all radiational facility (5);

- classification and unification of various types of wastewaters into different classes which permits to develop a series of universal radiational modulas specialized to different classes of contaminations and various concentrations of admixtures;

- a developed mathematical and computer modelling for the clean-up processes of water and flue gases;

- studies of combined radiolytic processes (e.g. electron beam+UV, electron beam+ultrasound etc.) which offer, due to strong synergistic effects, much larger yield than in pure radiolytic process.

All these inrovations, taken altogether, make it possible to develop new technological schemes, methods and equipment which would be able to clean-up effectively, sterilize, desodorize and decolorize huge volumes of contaminated water.

Thus the present talk is planned to give a comprehensive review of both present day and new technologies for electron-beam treatment of waste- and drinkwater and associated problems of water sterilization and general cleanup. Special attention in the talk will be paid to economic and commercial aspects of the e-beam technologies and their comparison with wastewater treatment methods currently accepted over the world.

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MULTIPURPOSE FILTERS "DANA"

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Compact multipurpose filters "Dana" are designed for underground and surface waters treatment at the water supply stations with capacities from 100 cubic meters per 24 hours to 8000 cubic meters per 24 hours. The filters operate in free-flow mode and are installed as a rule out of doors.

The designers of filters took into highest possible consideration all the previous defects of the existing head-free filter plants and eliminated them. They have developed a typical series of filters with nominal capacity of 200, 500, 1250 cubic meters per 24 hours. The real service conditions and the number of filters are determined with taking into account the water quality and real water supply conditions. The block composition of the filter design allows to select its individual units depending upon the specific technological requirements.

We are established technological ties and manufactures filters with taking into consideration local conditions. The priority avenue of application: deodorization, deironing and demanganation of underground waters; clarification and decoloration of surface waters; preliminary and advanced treatment of sewage water.

Also technology is designed for treatment of mountain springs water the quality of which depends upon the meteorology. The technology provides for clarification of water in cause of sharp turgidity from 1.5 - 2.0 mg/dm^3 to 0.5 - 2.0 g/dm^3. This technology is applied for water treatment stations with the capacity of up to 8000 cubic meters per 24 hours. The block set of installations permits to provide for maximum flexibility of the operation cycle at their service.

This technology and water treatment installations have been officially accepted in the conditions of the Carpathian Region of Ukraine.

New sorbent is designed for the use in the water treatment technology as a granular material of water treatment filter unit for drinking purposes. The offered material may be used for water treatment both in the industrial and domestic conditions. The natural modified sorbent is recommended for application in the natural water treatment for the manganese compounds disposal and for the advanced waste treatment to eliminate the residual ferrous concentrations.

The advantage of the natural modified sorbent over the existing analogues consist in the relatively simple method of obtaining it and higher effectiveness of its application for account of more secure confinement and distribution of the catalytic film on the grains of the material. In addition to the main designation (demanganezation and differization) the offered material allows to reduce water chromacity, smack and smells as well as to partially eliminate hazardous admixtures such as radio nuclides, heavy metals and ammonium.

Table.

Water quality indexes	Approximate quality of the initial water	Effectiveness of water treatment
Smell, magnitude	3	0
General iron, mg/dm^3	0.5 - 1.0	0.05 - 0.00
Manganese, mg/dm^3	1.3 - 3.0	0.05 - 0.00
Radio nuclides Cs^{137}, ku/dm^3 Sr^{90}, ku/dm^3	 10^{-7} - 10^{-9} 10^{-7} - 10^{-9}	 85 - 99 % 85 - 92 %
Ions of heavy metals (Cd, Ni, Zn, Pb), mg/dm^3	up to 3	90 - 98 %
Ammonium nitrogen, mg/dm^3	1.0 - 10.0	90 - 98 %

Water treated by the modified sorbent possesses improved bacteriological properties.

Research of Development Institute (NIKTI GH) carries out the technology surveying with taking into consideration the local conditions, producing non-standard equipment and special designing of water scoop structure.

Address for preliminary orders for filters and technological works: box № 679/2, Kiev-200, 254200, Ukraine, A. Kulishenko.

THE COMPARATIVE ANALYSIS OF WATER DISINFECTION USING OZONIZATION AND CHLORINATION

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Both reagent and non-reagent methods are used for disinfecting water. The former includes chlorination, fluorination, ionization and ozonization; the latter - treatment of water with bactericidal rays, magnetic and electric fields.

At present the commonest ways of water disinfection are chlorination and ozonization. Treating water with ozone has obvious advantages over chlorination, namely:

- high oxidation potential of ozone and hence much better bactericidal qualities as compared with any other chemical agents;
- ozone affects not only the reduction-oxidation system of bacteria but also their protoplazm;
- ozone reaction time is 15 to 20 times faster than that of chlorine;
- it takes 2.5 times less ozone than chlorine;
- ozonization contributes to an increase of water dissolved oxygen and gives water its original freshness typical of natural water sources;
- ozone is effective in removing extraneous smells and after-tastes.

Thus water ozonization is the only modern method of treating water. It is also universal since ozone action is manifested simultaneously with respect to its bactericidal, organoleptic and physical properties. From the chemical point of view the minerals dissolved in water and determining its quantitative composition do not change after ozonization has been applied. Also no additional foreign substances are introduced into the water when treated with ozone.

The advantages mentioned above have made it possible to develop a simplified method of water treatment which is devoid of the coagulation assembly, second pump and reaction tank.

Four patents have been issued which support the novelty of the technical solutions used in this development.

THE PROSPECTS OF DEVELOPING CITY WATER SUPPLY

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At present chlorination, ozonization and bactericidal irradiation are used for disinfection of water. The last two methods have a number of well-known advantages over chlorination. However they possess one drawback which prevents their wide use in water-mains structures. The drawback in question is the absence of preservative qualities which leads to the necessity of using chlorine as a preservative before water is fed to the water supply network to prevent its secondary contamination in water pipes.

Thus the advantages of using ozone and ultraviolet rays for water disinfection are canceled out by the inadequacies of the existing water supply network.

At present there are two ways to solve this problem: wither a complete replacement of the existing water pipes and fittings of the centralized water supply network with anticorrosive smooth pipes and fittings or additional purification of chlorinated drinking water immediately before consumption.

it should be noted that the first alternative is unfeasible under present conditions due to heavy financial expenditures needed to procure the materials and to replace the existing water pipes.

Thus the only way of obtaining drinking water in accordance with the sanitary requirements is to design domestic devices capable of additional purification of chlorinated water based on the latest processes, one of which is ozonization.

However, two problems have to be solved before this method is widely used: firstly, obligatory dechlorination of water before ozonization, secondly, subsequent deozonization to remove the residual ozone.

Both these tasks can be solved either by using special adsorbents to remove the residual reagent or by letting the water stand in open vessels. the latter variant is preferable for domestic use since it does not require expensive equipment.

Taking into account a small amount of drinking water consumed by an average family of 4-5 persons (15-20 liters per day), it is advisable to develop a device processing portions of water rather than working continuously. this leads to reduced dimensions, lower electricity consumption

and smaller total costs. Moreover, a precise dosing of the reagent is not needed.

Taking into consideration the above-mentioned factors, the authors have developed a portion-type device which additionally purifies drinking water. Its main parts are: a 15-liter tank, ozone generator and a filter with activated carbon. The filter is designed for separating the oxidation products, which considerably increases its service time before regeneration is needed. Power consumption of the device is as low as 30j wt/hr.

MAIN SCIENTIFIC DESIGNS OF THE SCIENTIFIC-RESEARCH AND CONSTRUCTION-TECHNOLOGICAL INSTITUTE OF UKRAINE MUNICIPAL ECONOMY IN THE FIELD OF WATER SUPPLY

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The Water Supply Department of SRCTI ME as a leading one in the system of Ukraine Residential Municipal Economy Within the problems of scientific-engineering progress in the field of drinking water purification engineering processes advance is comprehensively studying during the 30-year period of the Institute existence a problem of water quality in the centralized water supply sources and some techniques of water treatment at the municipal water supply lines accompanied with the stable providing for the standard regulatory requirements for potable water, solving the problem of reliability and efficiency of the municipal water supply lines operating. The Department has achieved some definite results and has its own innovations proposing and recommending for the further extensive application:

- pneumo screens designed for the water intake installations protection from some floating objects, petroleum products, phytoplankton;
- the technique and installations for combating the slush ice, Dreissenae;
- the technique of phytoplanktons removing;
- advance of water intake installations improvement;
- some technological processes of preliminary water purification;
- some optimal water purifying techniques with developing and utilizing the new reagents, coagulants, floculants, oxidative agents, decontaminating substances, pulverized zeolite and other sorbents;
- thin-film modules for water clarification;
- contact coagulation on the filters;
- complex technologies of carbonation, oxidation by potassium permanganate, water ammonization, preventing some chlororganic compounds formation, application of fractionated clinoptiolite for the filters loading;
- a technique of highly contaminated surface and underground water purification accompanied with ferrum, ammonia, manganese, ions, after-tastes and odors elimination;
- some technologies and installations designed for defluriation, artificial replenishment of underground water, radial water scoops, the Far North regions water purification; improvement of water deferrization filters constructions of industrial output;
- local, group installation and individual domestic filters of drinking water repurification;
- regulation and locking devices, deep-well and discharge pumps;
- automatic double-step unidirectional valves hydroshockes damper and so on.

One of the most important is the urgent problem of water ozonization. At Kiev Dneieprovskaya Water Supply-Line Station some domestic engineering lines of ozone generators with their capacity in 30 kg of ozone generators are being applied.

A great number of above listed developed technologies and constructions were protected by the Author's Certificates, Patents and were widely introduced into the practice.

Presently under Ukraine STATE residential-Municipal Administration by the Water Supply Department of SRCTI ME jointly with some institutions and organizations the National Programmes on supplying Ukraine population with quality drinking water have been developed including aqua resources state and water quality at the centralized water supply sources, the juridical and legislative bases of drinking water quality increase, standard, regulative, scientific, exploitation, economic issues, monitoring, water preserving and protection, drinking water rational using and so on. The Program has been approved by Ukraine Government and is utilized in the country water and sewage economy field.

EXPERIENCE IN SITU OF PURIFICATION OF UNDERGROUND WATER FROM IRON AND MANGANESE ON WATER-SUPPLY OF THE KOMSOMOLSK-ON-AMUR

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In 1991 on Mostovoi water-supply the positive results were received at testing the technology of purification from iron and manganese of groundwater in situ.

The thickness saturated rocks, including sand and pebbles, changes from 34,8 m up to 51 m. The mineralization of groundwater does not exceed 0,3 g/l.

Content of the general iron changes in limits from 10 up to 50 mg/l. The content of the free CO2 outside of a zone of the active influence water-supply does not exceed 42 mg/l, and in the limit a number wells reaches 200 and more mg/l. pH changes from 6.5 till 7.0. The size of Eh changes in limits from -100 up to +100 mV. The alkalinity of the water - 2-3.

For the purification from iron and manganese the method in-situ is applied.

Up to significances Fe smaller 0,05 mg/l and Mn - up to 0,4 - 0,5 mg/l and under was by practical consideration proven, that in given conditions, at expenditure of water from wells - more than 100 m3/hour, probably diminution of the contents of an iron on a accepted technique of clearing. For the specific degree of the clearing of the groundwater, in these conditions, it is enough to the increase Eh of a water up to 200 mV as a result of the swing to the situ the aeration's water with the concentration of the dissolved oxygen from 9 up to 11 mg/l.

In 1993 - 1994 the works on introduction of the geotechnical methods of purification of the groundwater were executed on the water-supply AO "The Komsomolsk oil refining plant".

The saturated rocks are submitted which pebbles, sand and gravel with inclusion of the boulders, the stratum of conglomerate and clay. The power of the aquifer changes from 74 m to 81 m.

Mineralization of water 0,1-0,15 g/l. The content of free CO2 - 20.0 - 40.0 mg/l, the size of pH has made 6.4-6.8, Eh - from - 20 up to a plus 93. The content of petroleum - from 0.6 up to 1.0 mg/l. The alkalinity of the water is in limits from 0.7 up to 1.5.

The application of technology in-situ has allowed to lower the content of an iron more, than in 10 times (with 8 - 10 mg/l up to 0,3 - 1,0 mg/l) and to remove the wells on the operational mode with the stable submission of the water with concentration Fe<1,0 mg/l.

Except the iron, in the submitted water to consumers has managed to lower the content of the following components: petroleums - from 0.6-1.0 mg/l up to 0.34-0.55 mg/l (in 2 times), nitrate - from 0.3 up to 0.0 mg/l (on the order), nitrite - from 0.05-0.5 up to 0.0 mg/l and the silicic of a acid (H_4SiO_4) - from 8.32 up to 2.08-4.16 mg/l.

STRUCTURE AND PROPERTIES OF ALUMOSILICATE COAGULANTS

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Nepheline - natural alumosilicate interacts with diluted (8-12 %) sulphuric acid , forming so called alumosicate coagulant (ASC). In the first approach ASC is mixed solution of alum and liquid glass. At pH= 1.5-2.5 this system is aggregatively unstable. It means, that in solution must be polycondensation of silica acid with following gelation. Actually we can observe gelation ASC, but at low temperatures (less 18° C) the life time exceeds several weeks, while in the model system with the same chemical composition take place instant gelation. In this connection, taking into account a wide perspectives application of ASC, establishment of stabilisation mechanisms is important.

Investigation of coagulation ability of aluminium sulphate (AS) and ASC relatively to silicon oxide sol allow to establish, that in the presence of AS takes place recharge of the surface of the particles of silicon oxide, while ASC can not recharge the particles. This results indicates , that aluminium ion in ASC is in the connected (complexed) form . Ultrafiltration measurements in connection with photon-correlation spectroscopy shows , that in ASC there are not any dispersed particles with size more 2nm. The obtained data allows to conclude, that ASC has complex alumosilicate ions, with destructs at pH > 5.5-6.0. Addition to the ASC solution polyelectrolytes stabilise its structure and permit to increase the life time of ASC.

The structure of ASC determines the features of ASC application. The optimal region application of ASC is at pH 6.8-7.2, where the molecular structure of the solution destroys and takes place formation of the high developed surface of finely dispersed particles of silicon dioxide and aluminium hydroxide.

SUPPLY OF KAZAKHSTAN MINING REGIONS WITH UNDERGROUND WATER

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In Kazakhstan 70 towns, more than 4000 populated areas and 100 enterprises are supplied with underground water. More than half of underground water resources are in the Southern regions of the republic.

Investigations revealed that more than 50 % of serviceable underground water resources, used for centralized supply of mining enterprises and settlements, are mainly localized in Quaternary alluvial and proluvial deposits, composed of sandy-gravel and boulder-pebble beds. They form piedmont plains, alluvial fans, valleys and river deltas.

Crevice and cavern water from Devonian Carbonaceous structures, especially in the mining regions of Central and Northern Kazakhstan, is on the second place. 20% of mining industrial enterprises in the republic use crevice-cavern water.

Alongside with underground water surface and drainage (mining) water is widely used.

Underground water, participating in solid minerals flooding, is investigated not only for draining measures substantiation, but for finding out opportunity of drinking and technical use, valuable components extraction balneological purposes, etc. In this case they are considered as associated useful minerals, combined in space with ore deposits.

At the same time mineral wealth and environment protection should be taken into account.

THE INTRODUCTION OF ADVANCED TECHNOLOGIES AND MACHINERY IN SEWAGE PUMPING STATION OPERATIONS IN MOSVODOKANAL

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Sewage pumping station operation division is a structural element of Mosvodokanal State Enterprise. They provide for the transportation of the wastewater along the gravity sewage collectors, through the distribution chambers to the wastewater plants.

The introduction of advanced technologies and machinery is one of the primary tasks reflected in the adopted programme which includes:

1. The introduction of computerized control of the pumping stations.

The control system has been developed and introduced by SATURN-90 Company in collaboration with our engineers. The system comprises a centralized information control system for 69 pumping station, i.e., over the entire city. The pumping stations subject to the computerized control are equipped with programmable technical means for data acquisistion and transfer specially developed for Mosvodokanal needs by SATURN-90. The information on the state of the pumping stations is transferred by non-gated telephone lines which have need assigned to the central control room by Moscow Telephone Network. The computerization of the pumping stations contributed much to the prevention of emergency situations.

2. Advanced solutions of reliability of the pumping station operations. Reliability and long operational life are of vital importance. The vertical pump units were designed more than 20 years ago; however the materials and technologies are out of date.

The main drawbacks of the old pump units design are:

- short life time of the sealings;
- short life time of friction pair working in liquid medium;
- errosiive and abrasiive wear of the working impellers and pump housings;
- low quality of the packings (monthly replacement) in vertical and horizontal pump units.

Mosvodokanal in collaboration with Morskaia Technika Association have found a number of efficient solutions which improved the reliability of pump units, decreased the labour input of the assembly and repair works, and increased the life time of the pump units.

2.1. Seven units of flexible shaft lines have been designed and assembled at Lyublino pump station.

The flexible shaft line has been designed by installing 2 elastic titanium couplings into the shafting. The flexible shaft line can provide for the normal operation of a vertical pump unit in case of the motor and pump shaft misalignment more than 5 mm and angle shift to 4 degrees.

2.2. Following the design documentation working impellers have been manufactured from TLZ titanium alloy. They are exceptionally strong and resistant to abrasive wear. The operational life of such an impeller is 100 000 hours (compared to 20 000 hours of impellers made of grey cast-iron).

2.3. A guide bearing not previously used in the pump units has been designed and manufactured. Wear-resistant antifriction material (graphite and plastic) replaced the traditional rubber and lignin-base laminate. The new design is characterised by low friction coefficient (around 0.002), high specific

load (to 30-40 kg/cm^2), and peripheral velocity to 40 m/sec.

Another important characteristic of the guide bearing is self-compression which allows to save the tap water. The existing bearings require 60 l/min of water for cooling purposes compared to the new model which consumes 4 l/min.

2.4. GORE-GFO packing with T from -240 to +240 degrees, V_{max} = 20 m/s, pH 0 - 14; P from 20 to 200 kg/cm2 replaced the old An, All 31 packing. The new packing has longer operational life (around 1 year).

3. Russian made 2 submersible pumps with Q = 800 m^3/h and H = 27 m have been designed and introduced by "Konversia" company.

4. Flygt submersible pumps (Sweden) are widely known. At present 62 Flygt pump units both dry and wet version have been in operation for 7 years at Veshki and Lipki pump stations. The operation of submersible pumps in the process of building new pumping stations allows to lower the construction and assembly costs; decrease labour costs for repair works; to increase the reliability of the pumping stations in case of emergency, i.e. power failure.

FOR RUSSIAN MANUFACTURERS: EUROPEAN QUALITY

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Prezent enviromental situation presses water users to look for efficient state-of-the-art water purification systems. It also encourages Research and Development specialists together with Original Equipment Manufacturesrs to improve constantly their systems, thus making them more reliable and less expensive.

Changes that occur in Russia now offer new perspectives for water users as well as create additional problems for enviromental enqineers.

Water quality standards become more strict and this fact also requires new approach to develop drinking water systems, boiler feed, industrial water production as well as to manufucture equipment and components.

The wide scale of private sector development (individual housing and enterprises) also encourages water specialists to develop widely-used techniques supplied with standard components. This facilitates efforts undertaken by manufacturers and operators together with research and design specialists.

To meet these problems, CWG Moskau GmbH, as Moscow branch of the world-wide water treatment facilities supplier, offers our cooperation with anyone who is interested in development and idustrial application of different water systems. These water systems could be based on different processes starting from flocculation and filtration to sorption and ozonation processes, as well as reverse osmosis. We offer for Russian home manufacturers wide range of piping, tubing, pumps, electronic panels, reagents and chemicals, sorption and filtration materials, ion-exchange resins, pressure vessels, reverse osmosis membranes.

Along with components and equipment supply, CWG Moskau GmbH also offers wide-range consulting and supply of turn-key water treatment systems to be used for houses, enterprises, boilers, hospitals, swimming pool etc.

EXPERIMENTS CONCERNING SORPTION OF WATER FROM THE MOSKVA WATER SOURCE

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Experiments on the evaluation of drinking water fine purification efficiency through granular activated carbon filtration were conducted during 1994-1995 using the continuously operated experimental plant of the output of 9 m^3/day located at the premises of pilot treatment facilities of Rublevskaja Water Treatment Plant of the City of Moscow. Different types of granular activated carbon were tested; the experiments revealed the advantage of granular activated carbon treatment combined with preozonation. Biotests revealing the trend to water toxicity decrease following sorption treatment were conducted under the supervision of Dr. Tsiplakova (F.F.Erisman MNIIG Moscow Research Institute).

After the first 2-3 months of granular activated carbon filters operation a sharp drop in the efficiency of organic contaminants removal (characterized by permanganate value) was noted (15-20 per cent instead of 50-60 per cent). Nevertheless the efficiency of permanganate value decrease during the ozonation process was in general about 20-40 per cent higher. At the same time during the whole test period the stable removal of odor was achieved (the water source is characterized by water odor intensity of 2-3 units).

Continuous operation of granular activated carbon fine purification filters during two years resulted in their efficiency considerable decrease (concerning the removal of admixtures of natural origin and partially concerning the removal of organic xenobiotics entering during peak conditions operation - pesticides, aromatic and polyaromatic substances, organic chlorine compounds). Artificial water spiking with xenobiotics at the level of 10-100 MPC revealed the high efficiency of sorption treatment stage proper concerning all the xenobiotics tested in contrast to ozonation process.

Ammonium nitrogen concentration in the Moskva River water changed from 0.2 to 0.9 mg/l (under flood conditions) and the efficiency of this concentration lowering following coagulation and settling was within the range of 0-46 per cent and following sand filtration it was within the range of 13-30 per cent. The ozonation was accompanied with the increase of ammonium nitrogen concentration of the organic matter of a certain nitrogen content.

Nevertheless the carbon filtrate from the treatment process without ozonation contained ammonium nitrogen twice as much as the filtrate from granular activated carbon filters used for the ozonation process. The biological nitrification process was more efficacious when an "old" granular activated carbon bed (with biofilm developed) was used and at higher water temperature in summer. The process efficiency increased with the increase of water-to-filter bed contact time.

Experiments revealed that in case of the Moskva River water treatment the nature of "background" organic contaminants removal from the water recommends the contact time of 15 minutes minimum. This parameter is also optimal for the prevention of nitrite concentration increase (nitrites are the intermediate product of biological nitrification process).

According to average data the microorganism content of a granular activated carbon filter filtrate is similar to the microorganism content of a send filter filtrate. In case the filter bed washing was not performed periodically the increase of total microbial count and coli-index in granular activated carbon filtrate was of cyclic character. According to test results the practical operation of sorption filters require granular activated carbon filter bed washing once per 3 days minimum plus the discharge of the first filtrate produced after the washing during 15 minutes.

ADSORPTION OF TAP WATER COLLOID CONTAMINANTS AND FULVIC ACIDS ON ACTIVATED CARBON FORMED FROM ULTRADISPERSIVE POWDER

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Our previous paper (International congress "Water: Ecology and Technology", 1994, V.11, p.508-516) was devoted to investigation of tap water colloid contaminants. The toxic hazard to human health the necessity of removal of these contaminants from tap water were observed.

The aim of this paper is to characterize the adsorption of colloid tap water contaminants on activated carbon (АУГ), formed from ultradispersive powder (created at St. Petersburg State Technological University).

Four types of activated carbon (АУГ-50, АУГ-33, АУГ-30, АУГ-15) were used. Sorbents studied had the following parameters: surface area 50, 30, 28, 15 m^2/g, respectively, effective pour radius - 50, 65,80, 140 nm.

The investigations were conducted in the regime of flow contact. Linear filtration rate was 1.0-2.0 cm/min. The volume ratio activated carbon - tap water " constituted 1:125 - 1:300.

There were determined two parameters: concentration of polluting colloid particles, ν, (by flow ultramicroscopy) and concentration of protein incorporated into colloid particles, C_p, (by protein assay method specially devised by us).

The efficiency of water purification from colloid particles and protein, the values of specific colloid particles adsorption ($a_ν$, part./m^2) and specific protein adsorption (a_p, microg/m^2) at "carbon - water" volume ratio 1:125 are illustrated by Table 1.

Table 1.

activated carbon type	% of purification		a_v,	a_0
	from coll. part	from protein	part./м^2	microg/м^2
АУГ-50	38	36	$0,6 \cdot 10^9$	1,3
АУГ-33	28	27	$0,6 \cdot 10^9$	1,4
АУГ-30	58	59	$1,3 10^9$	3,7
АУГ-15	98	32	$4,9 \cdot 10^9$	9,5

There data are demonstrated the increase of purification efficiency with the increase of activated carbon pore radius.

The adsorption of fulvic acids (the stabilizer of colloid tap water contaminants) on activated carbon АУГ-33 was also investigated.

There were obtained the isotherms of adsorption in a wide range of pH, there were determined the isotherm's constants: a_∞, K.

The kinetics of adsorption process was studied too.

IMPROVING THE RELIABILITY OF THE WATER NETWORKS AND THE RESTORATION OF THE THROUGHPUT USING THE EQUIPMENT FROM NIEDUNG COMPANY

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Water network is the final member in the technological flow scheme of the municipal water supply. The water abstracted from the source and conditioned to the drinking standard is distributed through the network around the city directly to the consumers. Any failure in the distribution network may cause interruptions in water supply and bring to nothing the efforts and resources involved in the previous steps of the technological process. Considering the fact that the costs of the network construction total more than 50% of the cost of the entire water supply system, the reliability of the network operation should be paid special attention.

The reliability of the entire network operation depends much among other factors on the pipe strength. The municipal water network with the length of 10 000 km consists by 70% from steel pipes.

In the process of operation the unprotected inner surface of the pipelines is subject to corrosion and mineral, and biological encrustments. The holes which result from the above-mentioned processes (70-90% of all the damages) decrease greatly the throughput of the pipelines (down to 40%). The statistics on the pipeline failures in Moscow shows that the frequency of unprotected steel pipes alternates from 0.1 to 1.1 per 1 km a year depending on the diameter (minor values correspond to big diameters). In addition, it was found that the probability density follows the exponential law, whereas the rehabilitation time for a steel pipeline follows the Weibull distribution.

The original operational parameters of an old pipeline can be restored either by relaying or relining. Pipeline relaying is a very expensive and difficult job especially in density populated areas with numerous public utilities. The only possible way is relining.

MOSVODOKANAL State Enterprise has gained much experience in relining the pipelines with cement-sand mortar. UNIMOS Ltd. specialises in rehabilitating 100-600 mm diameter water pipelines in Moscow using the technology from Christiene Niedung GmbH.

The cement-sand mortar is applied by centrifugal method through a pneurnatic thrower nozzle of the coating machine which is pulled through the pipe with the cable winch. The pipeline has to be cleaned before lining to remove the encrustments. Mechanical cleaning is carried out by scrapers with gear and circular plates, and by rubber reels with plastic pistons.

Cement-sand mortar is an environmentally friendly coating and possesses both passive and active effects in relation to metal corrosion. It improves the hydraulic characteristics of the pipeline forming a smooth hydrophilic layer of smallest clay and ferric - manganese particles on the inner surface. The occurrence of failures in the relined pipelines decreases ten times, whereas the operational life increases 2-3 times.

NEW ADVANTAGEIUS FACILITIES FOR REAGENT TREATMENT OF NATURAL AND SEWAGE WATERS, EXPERIENCE OF PRACTICAL USE

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Ground water which is used for industrial and potable services is often contaminated with oil wastes, heavy metals, pesticidis and organic nonoxidized impurities. Therefore some new compact horizontal and radial settling tanks as well as flotators with internal mechanical flocculation cells and thin-layer blocks have been elaborated at present. Compact filter-flotators have also been developed.

The use of the above mentioned installations in each particular case along with the use of modern coagulants (polyaluminum chloride, aluminoferrous coagulant, oxide aluminum sulphate and so on) the content of which is 1.5-3.0 times less than ordinary doze make it possible to improve the quality of potable water.

The quality of the resultant water exceeds some requirement of the new specifications called "Potable Water". In this the capacity of treatment plants increases up to 30% and at the same time the volume of the sediment becomes smoller. There is no need in constructions work when improving existing installations. The use of such installations is particularly efficient in systems for industrial and potable water supply. The capacity of the treatment plants is as high as 500-5000 m^3/hr.

Some modern factory-made schemes and facilities of great efficiency have been elaborated for treatment of combined industrial, domestic and rain-water effluents, their capacity varies from 3 to 100 m^3/hr. The installations allow it to remove impurities from wastewater including suspended particles, oil waters, heavy metals, grease, fat, surface active matter, sulphides and so on, and meet the requirements for dischange into water reservoirs.

The utilization of useful components has been made under the process of treatment. The quality of the water corresponds to the required degree of the recycling water supply.

One of the modern facilities is a compact apparatus where combine processes of hydrociclonic such as sedimentation with the use of reagents including a mixer and a froth cell, sedimentation in a thin layer or flotation-filtration can take place. Combination of the above-mentioned processes of treatment depends on the initial properties of water and requirements for discharge into the water reservoir.

Some physico-chemical and biological treatment plants have been developed to clarify combined industrial and municipal sewages, they also meet the requirements for discharge into fish industry reservoirs.

Use is made of various types of settling tanks and flotators with froth cells the capacity of which is 10 to 50 m^3/hr and even more than 1000 m^3/hr for the treatment of industrial and ground waters.

If modern reagents are added at the stage of traditional mechanical treatment they allow it to remove from the water up to 80% of suspended particles, 75% BOD, 95% phosphate, 90% heavy metals. In this 1 Kw of power consumption is quite enough for removal of 6-10 kg COD.

In realization of the all mentioned technology and structures it is necessary to analize the local origin of the effluents and the conditions under which the secondary use of the treated water is possible as well as the fact whether the water is discharged into the city sewerage or into the water reservoir.

BUILDING A MEASURING AND INFORMATION SYSTEM FOR THE ANALYSIS OF MOSCOW WATER NETWORK

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The Moscow water system is one of the biggest in Europe. It supplies water from four remote sources through a number of big regulating waterworks, hundreds of booster pump stations and a highly developed network. The changes in the operation mode of any of the water sources results in the redistribution of the feeding zones and changes in water supply of the big districts. Efficient control of such large-scale and comprehensive facilities has to be designed on the basis of a global information and measuring computer system.

The available software and hardware provide for the comprehensive calculations of real time water supply mode.

The most complicated task is to build an adequate mathematical model of the existing water supply system. The model identification is made by the method of successive approximation with the use of on-site flow and pressure measurements in the network, and at the fixed sample points. The place of portable instrument installation is determined by preliminary calculations. Every regulating

facility is equipped with fixed flow meters and pressure gauges. Spanner Polux and Irvikon ultra sonic flow meters are used for on-site measurements.

At present a comprehensive model of water supply and distribution has been designed for the southern part of Moscow. The analysis of the network operation with the application of the model allowed to improve the results. The calculations helped to reveal partially or completely blocked pipe sections which limit the throughput of the system, optimise the operation of a big regulating facility, design the options of the perspective network development for connecting new districts.

The following aspects are under the development:

- expansion and identification of the design scheme;
- development of network control options with the introduction of new regulation means; optimisation of the existing instruments;
- design of the data acquisition and processing system.

At the first stage the information and measuring system is used for the analysis of the network operation. In future the system will be developed into the "adviser" mode alongside with the installation of fixed measurement and automation units. In this mode the system will be used for the operational control with automation of separate units on the lower level.

MAKING SANITARY CLEAR WATER USING CROSS FIELDS

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A compact installation has been developed.

It cleans underground and surface water up to State Standard 2874 "Drinking water".

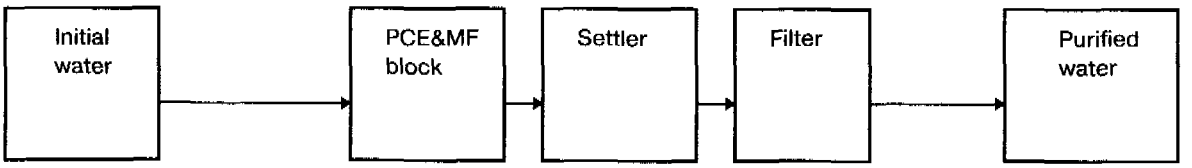

Fig. A compact illustration

Small PCE&MF block dimensions (100x100x10 mm),quick water preparation (1 hour), effective filtration based on zeolites and carbon-fibred filters, low energy capacity, simple usage, high purification quality (80-95%) and productivity (60 litres/hour) make it possible to use the installation in every day life and in industry.

It is possible to get an activated water with given pH for medical and agricultural purposes. The example of water quality changes after its treatment in the installation is given below.

Table.

Controlled indices. measurement	Index		Standard
	Initial water	After purification	
iron(+2) mg\dm^3	1.76	0.17	0.3
iron(+3) mg\dm^3	0.9	0.3	
Carbonate hard water mg\dm^3	58.5	1.0	7
Marganese mg\dm^3	0.49	0.09	0.1
pH	7.5	7.4 - 7.6	6-8
alkalescence eq\m^3	5.64	5.5 - 5.8	
dry residual mg\dm^3	132	48	

REVERSE OSMOSIS WATER DESALINATION PLANT OPERATION AND MAINTENANCE EXPERIENCES IN THE MIDDLE EAST

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"Water, NOT OIL will be the resource most at issue in THE MIDDLE EAST, by the year 2000 and that it could be the cause of increased tension or even ARMED CONFLICT" a report of The Centre for Strategic and International Studies, Washington, USA, in Technical Review, Middle East - April 1988. This report had exaggerated me to research in the field of Reverse Osmosis Water Treatment Systems.

Middle East States with thirsty deserts, humid and hot climate require more desalinated Water for its day to day life, agriculture and industrial progress as the aquifer's level is going down, salinity is increasing fast due to Sea Water intrusion and evaporation.

Raw Sea Water is abundantly available, so this resource development has been keenly studied by me for human benefit and reporting for further research. If The Middle East States Would co-operate with me the actual situations might incorporate.

Major desalination plants of the World are mushrooming in The Middle East due to high salinity of Brackish Water and the Rulers are spending more money for clean drinking water production to safe guard the health of it's Citizens.

If we would not collect the reject in artificial evaporation ponds for further treatment to use in agriculture, by the turn of the Century, Sea Water Total Dissolved Solids will be 66,000 p.p.m. or more. Compared to other seas of the region Arabian Gulf Sea Water if having the highest salinity. The pH is also coming down.

S.W.R.O. desalination plants can abundantly produce fresh drinking water for daily use. It can eliminate most of the heavy metals, inorganic, pesticides, hazardous chemicals, microbial contamination etc., and the product Water T.D.S. can be reduced to less than 500 p.p.m. (WHO Standard).

Red-Dead-MEd (Seas) channel connection peace agreement will boost S.W.R.O. desalination industry as it is the cheapest one.

Major studies have been made in S.W.R.O. desalination plant's pre-treatment Systems, R.O. Water Chemistry, Environmental pollution effecting S.W.R.O., biofouling case study and remedy, Operation and maintenance practical experiences.

Trying to solve problems facing R.O. Industry by accounting system of calculations (mean average) in water testing methods, hereby solved and reduced the Operating Cost to minimum.

Inventing one by - product form biofouling and further research required to develop three or more by-products.

Concluding the paper with Fifteen points for water Conservation in The Middle East States.

DEVELOPMENT OF NEW CATIONIC FLOCCULANTS AS REAGENTS FOR WATER TREATMENT

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Water pollution control and efficient water consumption in different technological processes are the most actual problems nowadays. During the process of water purification from suspended particles and also during the concentration and phase separation in suspensions there occure major problems which arise from the small size particles and from the high aggregative and sedimentational system stability. Intensification of these processes in many cases can be achieved by producing larger particles and transforming them into aggregates under the action of flocculants or coagulants and especially of their mixture. The prospect of increasing consumption of these reagents will remain in the future thanks to the simplicity, versatility and reliability of industrial water treatment methods with the help of flocculants and coagulants.

One of the most efficient cationic flocculants are the polymers based on 1,2-dimethyl-5-vinilpyridiniummethilsulfate (1,2-DM-5-VPMS).

Well-known methods of this polymer production with the usage of potassium or ammonium persulfate as initiator don't allow to achieve deep conversion of the monomer and high molecular weight. The presence of the monomer in flocculant imparts toxicity to the substance. The reagent with small molecular weight ([n]-1.0-1.5 dl/g) doesn't have the required activity as the flocculant.

We have developed the recipe and the method of obtaining a new efficient cationic flocculant based on 1,2-DM-5-VPMS. Original technological approaches based on the application of new initiatorsand

other special ingredients made it possible to carry out the polymerization process with the total yield of polymer at the low temperatures (0-30 C). These characteristic features exclude the conventional stages of degassing and polymer separation and they also permit to carry out polymerization in the transported containers, the recuired components having been mixed in the reactor. The flocculant produced in the form of aqueous solution has the basic substance concentration of about 40-50% and is soluble in water and its molecular weight is very high. ([n]-2.5-3.5 dl/g). These properties cause the high flocculative activity of the substance. Toxic properties of the polymer flocculant testify it the fact that this substance is a non-toxic one and it can be used in the water supply systems. Nowadays all necessary engineering specifications have been worked out and the pilot plant manufacturing cationic flocculant of "КФ-91" specification has been put into production.

The new flocculants of special complex forming properties and the special flocculant-coagulant compositions are under investigation now.

The application of "КФ-91" for the tap water processing of water bodies decreases the consumption of coagulants. The flocculant of "КФ-91" specification is successfully used as special reagents for intensification of technological processes and sewage treatment in pulp-paper mills and also for water depriving from the crude sediment in the city water treatment works.

Thus, provision of raw materials, price reduction possibility with simultaneous increase of production, adaptable technology that meets the consumers requirement and that gives further prospects of improving the polymer properties - all these things make the flocculant "КФ-91" one of the most promising reagent in water treatment processes.

RATIONAL USE OF NATURAL WATER AT ENTERPRISES OF HEAT-AND-POWER INDUSTRY

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Facilities of heat-and-power industry (power plants and large boiler-houses) appear to be the major consumers of water whose demand in industrial water supply of certain regions accounts for 40-80%. Therefore, a drastic change in conditions of water utilization in heat-and power industry is capable of making a weighty contribution to improvement of aquatic utility balance of industrially developed regions.

The problem is solvable through exercising two possible routes. The first one implies change-over of power plants and boiler-houses to non conventional water sources. At maritime regions - to softened and desalinated sea water, whereas at upland regions - to urban effluents subjected to after-treatment and decontaminated surface sewage waters.

The second route lies with modification of existing schemes and technologies of water use that could provide for cutting consumption of natural fresh water.

The most beneficial economically for maritime power plants would be a multipurpose employment of power complex, i.e. simultaneous generation of electric and thermal energy, and production of desalinated water. Advanced systems should provide for supply of softened sea water to stationary evaporators (with application of scavenging for regeneration of Na-filters), while high-pressure boilers should be fed with thus produced distillate. Apart from this, there has been developed and put to proof under in-service conditions of thermo-electric power stations located in the cities of Baku and Krasnovodsk a technology for immediate feeding of medium-pressure (4 MPa) and high-pressure (14 MPa) boilers with deeply softened sea water. Such development clears the way to origination of an open cycle of power plants and boiler-houses and implementation of water desalination process directly in large-capacity power boilers, which is three times cheaper as against evaporators.

Studied in every detail were alternative methods of biological and physico-chemical after-treatment of urban effluents (UE) making possible their application in recycle systems (RS) and by way of source water for water treating plants (WTP) of the power plants' main cycle. Specifically for RS, there have been conducted studies into peculiarities of such processes as formation of deposits, corrosion, build-up of biofouling and into conditions providing for reliable aqua-chemical mode when employing after-treated UE. Similar issues have been unraveled for the case of making use of decontaminated surface sewage waters.

Undertaken developmental efforts have resulted in originating some new and updating conventional water treatment technologies providing of perfect withdrawal of both mineral components and impurities characteristic of UE. Application of the said waste waters in power plants and boiler-houses will disposal of anthropogenous contaminants into natural water sources.

The second route to rational use of water envisions cutting the rates of water consumption by both each individual system and a power plant as a whole. Proposed for RS is a scavenging-free operation mode with reduction of water losses caused by drop entrainment. And, what is here essential, the challenge to achieve water savings should not, when met, entail more sophisticated conditions of aqua-chemical mode under high multiplicities of boiling-down. Conditions of drainlessness are at trainable

as well at application of scavenging water of RS in WTP scheme of the power plant's main cycle and heating system (HS).

Significant savings of water in make-up water treatment schemes of HS are achievable through transfer to application of scale-formation inhibitors (SFI) with consequent elimination of water consumption for captive use which for the case of ion-exchange water-treatment plants amounts to 15-20% of overall consumption. There have been developed technologies for combined treatment of HS's make-up water with SFI and by means of cationation. Considerable abounds of water will be saved i the systems for treating make-up water of the power plant's main cycle upon change-over from chemical desalination to thermal one characterized by less water consumption for captive use.

The highest efficiency is achievable through setting-up of integrated schemes which imply a combination of water treatment recycle, and waste water utilization systems.

RECONSTRUCTION OF OPERATING PLANTS TREATING COLORED WATER OF LOW TURBIDITY

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At present, in Russia the problem of drinking water quality is an object of attention of the public, legal and executive authorities, organs of state sanitary inspection.

Unsatisfactory state of centralized water supply systems providing people with drinking water is caused by a number of circumstances, in the first place:

– insufficient level of conventional treatment schemes. As a rule, operating plants on surface water sources were built using technology which has become out of date, being designed to treat raw water with small technogenic and anthropogenic pollution. At present, they are unable to supply sage water to consumers, since their barrier functions with respect to heavy metal ions, chlorinated organic compounds, phenols, oil products, intestinal protozoa and other widespread pollutants are extremely small.

The condition is aggravated by hydraulic overload of many treatment plants, absence of complete set of treatment units at 33 per cent of municipal and 46 per cent of various ministerial waterworks;

due to economic reasons, a delay in implementation of new technological processes, in particular of substituting chlorination by ozonation, which might lead to sharp decrease of chlorinated organics in water, adsorption by activated carbon, flocculation, and a number of others.

Technologies employed in native practice of water treatment need substantial modernization, first of all by stopping pre-chlorination or considerably lowering chlorine doses, using ozone, adsorption of contaminants by natural or synthetic adsorbents, using now more effective chemicals and filtering materials.

Realization of the above complex of measures, as well as implementation of analytical means for sanitary and technological control of water quality, require substantial and long-term investments commensurable with basic items of federal and local budgets. Under the heavy economic position of the country this is unreal for the next 30 - 40 years.

The presented report deals with results of studies carries out at the Water Supply Chair of the Moscow State Building University on improvement of technology for treating raw water of the North Dvina and Volga Rivers.

Volga water at the intake is characterized by turbidity of 5-24 mg/l, color - 45-120 deg., alkalinity - 0/9-1/8 meq/l, total hardness - up to 2.5 meq/l, pH - 6.8-7.4, permanganate oxidation - 10-24.7 mg/l, iron content - up to 1.4 mg/l, total dissolved solids - up to 145 mg/l. At separate periods of the year, oil products of 5-6 MAC and phenols of 4-5 MAC are observed.

Technological scheme of water treatment includes:

–two vortex-type mixing chambers, where chlorine, lime, aluminium sulphate are introduced; five corridor-type clarifies; five rapid filters with two-layer medium, disinfection facilities using liquid chlorine.

On the result of studies, it was recommended to: exclude prechlorination of water, substituting this by ozonation or by addition of oxidant mixture (hydrogen peroxide, chlorine oxide and dioxide, ozone, oxygen); use aluminium and ferric coagulants combined with clay addition and recirculation of sludge from clarifies and wash water of rapid filters; use adsorption of oxidized organic contaminants on activated carbon or clinoptilolite; use recirculators of sludge and lamella modules in suspended solids contact clarifies; reconstruct solids contact clarifies of contact rapid filters (KF-5 type), and existing rapid filters into adsorption filters with activated carbon, use polymer granular filtering medium; recirculate wash water and treat the sludge with a view of saving water and increasing ecological reliability of the treatment plant.

When treating similar water with temperatures of not less than 8°C, it is effective to use biological reactor with keramzite (expanded clay) or plastic carrier.

BOTTLING OF NATURAL ECOLOGICALLY PURE WATERS - PRINCIPAL PROMISING SOURCE OF FRESH WATER SUPPLY FOR URBAN POPULATION

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Conventional method of providing the urban population with fresh water by water - supply with the usage of all well - known methods of preparation and final water purification in domestic filters does not assure the water quality, which meets the requirements of World Health Organisation (WHO). The future well lie with the bottling of natural ecologically pure water, which is poured out just at water collectors. Bottling will be the main source of fresh water within the physiological demands of the human. Bottling fresh water supply of the population of Perm and other towns in Pre-Urals is possible to be provided at the sacrifice of mastering the Upper-Suksunskyi deposit of ecologically pure underground waters. These waters are suited to the requirements of WHO and the instructions of European Economic Community and can be used for fresh water supply pouring out the consumers packing without special reagent background.

TO PROBLEM OF WATER SUPPLY OF THE POPULATION

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The drinking water supply of the population now is one of the most sharp problems. The global pollution of nature is narrowing constantly the resources of natural fountains which permit water of demanded quality according to GOST 2874-82 and oriented for the drinking water supply. It is necessary to note, that the GOST 2874-82 contains 17 indices of normalizable chemical pollutions, while the list of maximum permissible concentration (MPC) for polluting substances in drinking and cultural and welfare water is 1272 (1). According to GOST state sanitary inspectors have the right to control the indices taking into account the regional specificities.

However besides they pollute water resources by water escape there is the problem of the second polluting of the drinking water in the process of its preparing. There are two main stages purification of sewage from suspended substances and chlorination. The aim of chlorination is destruction of pathogenic microorganisms. It being known that the drinking water in the water supply may be polluted by pathogenic microorganisms too, chlor is being brought twice to provides its contain in the water supply.

According to Recearch Institute of Hygiene and Professional Pathology (S-Peterburg, Russia, 1994), river water contains dozens of organic compounds including acids, phenols, aromatic and polyaromatic compounds, plastificators, aminoes and others (exceeding of MPC of them is not fixed). This compounds are active in the reactions with chlor. It is known, that in the case of water chlorination there are 50 chlororganic compounds made among them there are chloroform, tetrachlorcarbon, three-chloroethan. They have carcinogenic and mutagenic properties. It was showed positive correlations between the indices of the mortality connected with the cancer of rectum and urinary bladder and the content of the chloroform in the drinking water. As a rule (it is not tecommended by GOST) chlororganic compounds are not included in the list of indices (by state sanitary inspectors) being controlled. But it is the Gost's deal.

One of the main dashes formed while water chlorating is chloroform. Constant exceeding MPC of chloroform in water supply in Moscow is noted (2). In Kirovo-Chepetsk the middle concentration of chloroform is from 2.5 to 4 units of MPC, and in 1993 summer - 40 units of MPC (3). The USA Ecological Agency inform that in 1975 chloroform was found in all the test of chlorated water (4).

As we said before while chlorating water there may form dozens of different compounds any of them has toxic characteristics. It is difficult to describe all the chlororganic compounds, more difficult to analyze them. In some European countries the general content of chlororganic compounds is standardized in the drinking water. German and Czecho-Slovakian Standards foresee of norm of not less than 0.01 mg/l. There is no such a norm in Russia. They put 2-3 mg of chlor per liter of water. There chemical pollution forms it may be 1 mg/l. The scientists of Institution of Ecological Problems of the North say there are 0.04-0.06 mg/l of organic chlor in the Severnaya Dvina River near Arkhangelsk and in the water supply - 0.4 mg/l. The fact proves that the standards of chlorating of drinking water are not fulfilled.

Are there any chances to lessen the content of chlororganic compounds in the drinking water. Firstly, we may suppose that in most cases the process of chlorating the drinking water itself is not made optimum. There suggested some modern technic devision which will provide considerably lessing chlor expense. Besides the stability of

microorganisms against chlor depends not on the chlor concentration but on pH and redox potential of medium (5). The chlorating instructions which are use in water supply don't point to that fact. Secondly, there are reagents, that have such disinfect ability as chlor has but have less active chlorinate agents. For example, using of sodium gypochlorite permits to decrease the concentrantion of chlororganic compounds in drinking water to 30% (6). Thirdly, there are methods of purification of water from chlororganic compounds. The classic method is adsorption with the helps of active coal. This technology and special sorts of active coal, which it is possible to use with sandy filter instead of sandy , are devised, for example, by the firm "Chemviron Carbon"(7). At last, there is the technology of ozonization of water.

However, there are appointed limitations. For the water, be the subject of purification, with the help of active coal, they have very strong demands of concentration of suspended compounds. The obstacle in ozonization is presence in water humic substances, which are ones of the main sorces of the production of chloroform (4). Decomposition of organic compounds leads to the production of phenol and the subsequent chlorinating is not possible. Such result was received in the time of NIIKVOV test with the help of ozonization of water of the Cheptsa River. However, in 1993 there is the question: why there is chlorinating? Water, which is directed into the water-pipe should contain uncombined chlor - that is the demand of sanitary standard. This fact depreciates all previous devices.

But that's not the main fact. Putting into operation the standards for chlororganic compounds in practice will make it necessary to reconstruct all the water supply enterprises in Russia and that is too expensive. Besides it is reasonable that the expense of drinking water for one inhabitant is 190 liters per twenty-four hours. For drinking and food purposes it is necessary to use not more that 5 liters per twenty-four hours. It is not clear, if is it rationally to purify the rest 185 liters of water? We can see two oppositions:

- if we can give people bad (polluted) water instead of pure one;

- or make escape of water with chlororganic compounds into natural fountain?

In conditions of economical crisis - those are rhetorical questions. The cheapest means are using the plant of additional purring of drinking water - collective and individual ones. As the worth Instituition of Ecological Problems of the North mentions that the using of The filter "Rodnichok" provides the decreasing of the adsorbed organic chlor in water from 0.4 to 0.07 mg/l.

Kirovo-Chepetsk Administration came to resolution to provide the institutions with the filters for collective using.

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STATISTICAL METHOD FOR THE EVALUATION OF DISTRIBUTION NETWORK WATER QUALITY SAFETY

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The statistical processing of the data related to distribution network water quality aims at the evaluation of its sanitary safety applying qualitative criteria used for the analysis of engineering supply systems reliability. In this case the choice of these criteria is based on the wording of the concept of "failure".

According to the basic normative document which regulates the system of products reliability criteria (GOST "Reliability. Terms and Definitions") the concept of "failure" is interpreted as temporary or constant discrepancy of a product.

The adaptation of this interpretation to drinking water quality makes us understand "failure" as a

situation when at least one water quality index exceeds the limits for ingredients content changes established by GOST "Drinking Water." Nevertheless neither possible extent of such deviation nor its duration are indicated in normative documents (GOST, SanPiN) providing legal protection for consumers. And what is more, they do not directly forbid any deviations from the norm.

Preliminary evaluation of factual information concerning drinking water quality in distribution system according to standardized indices indicates that the violations of norms are not registered in fact. Thus the factual information concerning drinking waiter quality failures can not be considered to be statistically representative; the parameter of flow of failures is of extinctively small value and it can be adopted as a criterion of distribution system sanitary safety.

It is obvious that under the conditions of low representativity of any direct information concerning drinking water quality failures an indirect index should be adopted as a criterion for network sanitary safety. The adoption of this indirect index on the one hand would not lead to any significant change in the concept of "failure" and on the other hand it would make it possible to apply the whole volume of the information concerning water quality including temporal groups where the failure situations are not registered at all.

We propose to use the value of failure emergence probability as such a criterion. The introduction of this criterion as a qualitative characteristic of the network sanitary safety is based on the fact that the absence of failure during a certain period of time does not mean the zero probability of its emergence. From the statistical point of view the probability of failure may, in principle, be equal to zero. It may fluctuate within a broad range depending on two principal factors:

- water quality at the outlet of the treatment facilities;
- technical condition of distribution system during the period of quality safety evaluation.

Thus using the criterion of failure probability for sampling points chosen as control points it is possible to catty out a comparative evaluation of water quality formation within the locations characterized by the corresponding control point.

In this case the evaluation according to the criterion of failure emergence probability is performed both as partial evaluation (concerning every quality index being analyzed) and as integral evaluation (concerning the entire complex of drinking water quality indices). In this case the main methodological problem is proper the consideration of correlation (and of interdependency of quality indices for some groups of indices) and, correspondingly, the consideration of the influence the presence of one of the water quality ingredients exercises on the failure emergence concerning the other ingredient correlated with it. To take mutual correlation into account the correlation matrix for indices at every control point is calculated.

The correlation method makes it possible to predict the most probable reason for possible emergence of failure situation concerning drinking water quality at the network sections characterized by the corresponding control points. In cases of low value of correlation coefficient between identical water quality indices at the control point and at the outlet of the water treatment plant the condition of the network section plays the dominant role in the formation of this coefficient. And on the contrary, in cases of high value of correlation coefficients between corresponding indices the condition of the network section should be considered to be satisfactory. In case of increased failure probability it is necessary to correct water quality at the outlet of the water treatment plant.

UNIVERSAL TECHNOLOGY DEVELOPED FOR CLEANING AND CONDITIONING OF DRINKING WATER

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The report presents the results of work carried out in 1994-95 aimed at the development of a flexible cleaning and conditioning system designed for bottling natural artesian water.

The problem is rather imperative for large megalopolis conditions with potable water not meeting the WHO recommendations and where any centralized measures for improvement will require colossal investments.

The research was targeted on the development of principal basis and a flow sheet for a cleaning process which would provide stable quality, meeting the international standards, for moderate operational cost.

The process is based on the adsorption/microfiltration concept, utilizing selective inorganic adsorbents, carboxyl ion-exchanging fibers and mesaporous activated carbons. The exiting water was conditioned (recleaned) on microfilters with pore size 1-5 microns. All utilized adsorbents and microfilters are of domestic manufacturing. Testing of the cleaning system has proven it being capable to

produce high quality potable water with all useful minerals retained and all harmful impurities (iron, cadmium, ammonium, chlorine, phosphoro-organics, bacteria) removed. On the basis of the developed technology, we have designed and manufactured a commercial plant for cleaning and conditioning potable water "MOSCOVIYA" capacitive of 10 cubic meters per hour. In 1994 the plant was commissioned in the city of Zelenograd, Production Department Zelenogradvodkanal. The design of the plant facilitates a thorough cleaning by way of dividing the input water flow into two currents and cleaning them separately. The measure will also permit to further enrich the clean water with fluorine - the element so important for the Moscow region population.

The developed technology and equipment are protected by a number of the Russian Federation patents, an international claim according to the RST system has been issued.

MEMBRANE TECHNIQUES FOR DRINKING WATER TREATMENT

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Present enviromental situation could be attributed to constant contamination of natural water by dissolved toxic substances of antropogeneous oridgin like volatile halogenocarbons, heavy metals and radionucleids. The existing conventional water treatment techniques could hardly ensure sufficient removal of these ingredients. Thus a lot of vast research programs are being conducted currently to improve drinking water treatment processes.

During last years membrane water treatment techniques, such as reverse osmosis and nanofiltraton, become more and more popular. Polimeric composite membranes reject all molecular and ionic level contaminants, including sults, organic compounds, as well as bacteria and viruses. Nanofiltration, latest state-of-the-art low pressure membrane process is developed specially for drinking water conditioning. These membranes selectively reject divalvent ions (by 80-90%) and to lower extent reduce monovalent ions (by 50-70%).Thus, product water TDS value does not significantly reduce as compared to the feed water that conforms to drinking water WHO standards. But despite all membrane advantages, the existing membrane units are substantially complicated and require high operation and maintenance costs. This is explainned by the complexity of feed water pretreatment schemes. These pretreatment schemes contain the units that remove water ingredients that foul membrane surface and thus reduce membrane life, such as: colloidal particles, free chlorine etc. These additional pretreatment units obliosly complicates water treatment systems and do not enable us to make it fully automatic and wide-use.

To solve thise problem, we have undertaken a vast research program to understand and describe membrane foulity processes. The results of thise research enabled us to simplity membrane units and to develop more simple, reliable and cheap pure water "machines". Such "machines" could be used to supply pure water for individual houses, enterprises, clinics, small communities etc. The automatic machines are designed to supply pure water 24 hours a day without operators interference. High water quality is ensured for the feed water taken from different water sources: surface water, vell of centralized pipe system.

DEVELOPMENT AND INVESTIGATION OF POLYFUNCTIONAL SUBCTANCES, POLYMERS AND MATERIALS FOR CLEARING OF WATER FROM RADIOACTIVE METALS, BACTERIA AND OTHER CONTAMINATION IN MEDICINE AND ENGINEERING

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A method for creation of new class of polymers and conjoint polymers contained the charged molecules in long-chain for development of polyfunctional materials with high surface activity, complex-formed, anti-bacteria and functional properties is presented. The dependence between the activity of giant molecules and their constitution, structure, molecular mass)molecular mass from 300 to 1000000), quality of charge on conjoint polymer was obtained. In particular, it is possible to control the properties of polyfunctional materials by means of directional synthesis of conjoint polymers. Additionally, the modifying influence of polymers on the solid sorbents (for instance, zeolite, coal and etc.) was proved. These polymers contain the charged molecules in long-chain with a view to create the high-active filter materials for disinfecting and clearing of water from radionuclides (Sr^{90}, Cs^{137},

Pu^{235}, Hg^{203}), heavy metals (Fe, Cr, Pb, Ni and others) ions (F^-, CN^-, NO_3^- and others) and some organic compounds (phenols, acids and others). Also, the whole set of laboratory samples of new materials was sythesized.

SWIRLING INCOMPRESSIBLE FLOWS DYNAMICS AND THEIR EFFECTIVENESS IN THE WATER TREATMENT PROCESS

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Swirling incompressible flows are a matter of much considerable interest for process design of new high-ecology and water saving technologies, involving water purification from various detrimental impurities, degasing, and water measuring and regulator devices. In spite of a great number of swirling incompressible flow research, up to the present it fails to find wide use in water management processes for lack of theory, which could present in considerable detail and with perfect regularity the such flows and functional dependence between hydrodynamic and geometrical parameters. Under circumstances the commutative experimental data also has failed in resulting universal generalised functions [1,2].

This work gives an analytical treatment of the hydrodynamic theory, which furnishes an explanation of unknown to date laws of swirling incompressible flows and functional relations between their integrated properties and local parameters. The research has not been carried out on the basis of the most commonly used by various investigators the maximum and the other theoretically unfounded principles in order to close the sets of simultaneous equations, which describe the laws of conservation. Basically, it reduces to the uniqueness of a solution, that follows from properties of functional dependence immediately, passing through a maximum between the discharge coefficient of mass flow μ and the free area coefficient φ_p in the output channel. The results of theoretical investigations were verified by experimental data of various investigators [2,3].

The water treatment research based on [4] demonstrates, that when using the various combinations of hydrodynamic and geometrical parameters of the swirling water flows, it is possible to give rise to developed contact and free surfaces, rather thin flows along the cylindrical channel borbers, and also to receive both smooth and jump-like velocity increment and pressure reduction. From the facts at hand we may infer, that the geometrical height $\mathbf{h}_k$ of the swirling radial flows (vortex chamber) has stimulating influence on discharge characteristics, rate and completion of gas liberation, and also fluid layer thickness. As a result, the water treatment's technology process is integrated with the control actions to the full. The design procedures and the software have been set up for hydrodynamic characteristics and geometrical parameters determination of flow control devices such as deaerators and flowmeters. The operation of the devices depends on swirling water flows. Vortex deaerators are already in commercial operation.

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ECOLOGICAL ASPECTS OF COOLING TOWERS APPLICATION IN INDUSTRIAL WATER SUPPLY SYSTEMS

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About 150 km^3 water annually are spent in Russia for cooling of technological equipment. Cooling towers, especially fan type, are the most effective as cooling installations. As compared with cooling towers of tower type, splash basins and cooling ponds cooling towers of fan tyre occupy the territory of 1.5, 10 and 300 times less respectively.

The ecological problems of cooling towers use are arising by increasing of its capacity and numbering in industrial plants and as the result of short

distance of industrial plants to living areas and transport ways.

One can consider the cooling towers as the source of possible negative influence on environmental conditions as follows: thrust out of water drops, and harmful compounds, and noise.

Research activities of VODGEO from the middle of sixties are devoted to solution of the problem to avoid of thrust out of water drops. The great amount of research works have been executed and original method of prompt measurement of this phenomenon on model cooling towers and in natural conditions has been developed. Some normative requirements for permissible values of water drop leaving from cooling towers have been compiled. The design regulations of drop separators from different materials have been developed and many of these separators materials are produced in Russia. The cooling towers can be the sources of harmful influence on atmosphere, soil and water resources by use of industrial and urban sewage and natural mineral waters with great amount of salts as well. VODGEO and RF Health Ministry Divisions have developed the documents for applying of those waters in closed circuit cooling systems and standards of harmful compounds content in water drop leaving and standards for drop separators of cooling towers.

Drop separators with respect to ecological standards for all cooling tower types and sizes are produced in Russia by Techecoprom {Moscow}, Komposit {Moscow} and VNIIG {Petersburg}. Techecoprom produces series of small size cooling towers with high cooling capacity and minimum water drop leaving for closed circuit cooling systems with water capacity 500-1000 m^3/h and more.

The cooling tower as source of noise is an installation where sound can be produced by fan installation with drive system at low and middle frequencies in range 63-500 Hz and by water moving [rain noise] at frequencies 500-8000 Hz. VODGEO on the base of joint research works with Stroiphizika and GPISantechproject has developed the noise characteristics of all cooling tower types which are in use in Russia. Jointly with GPISantechproject the cooling tower noise method of calculation in living areas was created.

The problem of cooling towers evaporation has raised in our country in last years. It is solved by usage of wetdry and dry cooling towers. Division of "Minenergo", VNIINeftemash and VODGEO are incorporated in the solution of this problem.

Conclusions. Cooling towers are not the most dangerous installations for environment in industrial plants. In proper performance and maintenance they do not influence on environmental conditions.The use of cooling towers as a part of circuit WA-tour-supply systems provided the water saving in 25-50 times more in comparison with direct watersupply systems and avoiding of water resources contamination. Drift eliminators are produced in Russia for cooling towers of all types and sizes and for small-size factorymade cooling towers.

OXIDIZING-ELECTROCHEMICAL TECHNOLOGY FOR RENDER HARMLESS ECOTOXICANTS

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In the nearest years the most urgent water treatment problem, which is coming to decide, is: perfection of methods of clearing and complementary clearing of natural and industrial waste waters with the purpose of extraction from a water hard-soluble and toxic connections, decrease of material - power consumption of clearing structures, creation of installations of small productivity of factory manufacturing in set-block execution for independent objects (1,2).

Oxidiizing-electrochemical technology detoxification of ecotoxicants in water solutions by ecological pure oxidizers such as an ozone and a hydrogen peroxide is developed.

Opportunity and promisity of clearing of waste waters from hydro sulfide, cyanide of a hydrogen peroxide, generated electrolysis (3), and in work (4) joint oxidation by ozone and hydrogene peroxide of organic pollution was earlier shown at reagent complementary clearing of industrial waste waters.

In developed technology, besides electrochemical reactions of oxidation-reduction ecotoxicants, chemical reactions with hydrogen peroxide, generated by electrolysis, and chemical reactions with reaction-capability intermediate products of desintegration an ozone and a hydrogen peroxide proceed.

Laboratory researches to render harmless ecotoxicants of industrial waste waters are conducted: NaOH - 30 g/l, NaOH - 30 г/л, NaCL - 20-50 г/л, Na_2CO_3 - 10-48 г/л, Na_2SO_4 - 50 г/л, CHCL - 0,01 г/л, CH_2CL_2 - 0,01 г/л, CCL_4 - 0,01 г/л, CH_3OH - 0,1 г/л, $C_6H_4(CH_3)_2$ - 0,05г/л.

Is investigated a kinetic of oxidation of organic pollution, constants of velocity are designed.

The received results have shown, that efficiency of clearing by chemical oxygen consumption at simple ozonation of 43%, ozone-peroxide-electrochemical of 52%, and at ozone-electrooxidizing from 79 up to 93%. Should note, that at ozone-electrooxidizing treatment dehalogen process occurs from the first minutes, and at ozone-peroxide-electrochemical and simple ozonation after several hours. From ultraviolet spectrum of solutions, subjected various ways of clearing is visible, that the degree of render harmless of ecotoxicants grows in a number: simple ozonation>ozone-peroxide-electrochemical> ozoneelectrooxidizing

ozonation. Dissappeared a benzol band at L= 274 nm on a ultraviolet spectrum of a solution after ozone-electrooxidizing treatment.

Thus, the received the first results show promisity and necessity of continuation of resarches on development of oxidizing-electrochemical technology to clearing natural and industrial waste waters and installations of a direct electrolysis. Obviously, that ozone-electrooxidizing way the most effective way detoxication of a halogen-contenting hydrocarbons (including dioxine), toxicants.

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THE CONCEPT OF INFORMATIONAL ANALYTICAL SYSTEM FOR PERFECTION OF WATER PREPARATION TECHNOLOGY

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Modern water-supply city stations are expensive complex technical systems, the management of which suppose the use of modern informational systems for displaying technological processes conditions, controlling of water quality parameters at each stage of water preparation, collecting, processing and presentation of information in convenient for user form, automated issue of informational reports.

In the final form this informational analytical system can be realized as computer local net, connecting work places of the main technologist and operators, managing main processes (chlorination at various stages, ozonation, coagulation, sedimentation, filtration, ammoniation, etc.) and quality control service (general, physico-chemical and microbiological parameters). The concept of the system is developed by joint efforts of experts of L.Ya.Karpov Institute and the East Water-Supply Station of Moscow. It represents three-level system, using existing communications of the enterprise.

On the lowest level of the system primary information is going from gauges and devices, fixing current conditions of processes at each stage of water treatment. An information can be entered into information system from computer keyboard too. This information on balance of water and chemicals, physico-chemical parameters of water is going to work places of operators or attendant engineers, where it is represented in visual graphanalytical view as the current status of considered stage of water preparation. In the case of deviation of current parameters out of the allowable limits the system informs the operator and, if necessary, managers of enterprise about necessity of interference in the process. At the same time on the middle level of the system current information with required periodicity after averaging is transmitted to the computer, servicing analytical laboratories of quality control service. This service is carrying out water quality control analyses which are not checked automatically (or are measured alternatively) and input these results into the computer. One time a month the results of extended chemical and microbiological analysis of water, executed by external contractors, are also recorded in the database. All information, contained in the database is subjected to statistical processing, it is systematized and represented in generalized form as the current status of water content at various stages of water preparation and as report under the required form.

On the highest level of the system the technological and administrative information is concentrated at the work place of the main technologist as current statuses of main stages of technological chain and the whole process, utilizing both the technological parameters and parameters of water quality. Here the information is processed, analyzed, fixed under chosen criteria and documented. The appropriate subsystem provides automation of processes of the account, planning and management of technological process as a whole. The section, containing standards, analytical techniques, normative and other administrative materials is included as part in the highest level database. In the case of necessity of reception of the comprehensive information on the present situation or with the purpose of control the direct access by request of the main technologist is available in any part of the informational analytical system. The use of the informational analytical system will allow to reduce the chemicals and power costs of water clearing and water preparation processes with the help of optimization of technology management. Thus the re-

quired normative quality of drinking water will be supplied and decrease of specific account parameters of water use for own needs will be achieved. The application of procedures of search of the optimum decisions of technological problems, arising at change of parameters of initial water or at change of reagent brand or type and in some other situations, is possible only at sufficient level of informational technology. The term "technological situational analysis" appeared recently reflects as level of needs in informational analytical procedures, as productivity of development of appropriate techniques.

There is a number of local net standards, able to ensure the installation of modern informational technologies in scales of division or the whole enterprise (ETHERNET, Token Ring, FDDI and other), however neither of them is an ideal variant, especially in the case of video information transfer . The reasons are: limits of passband for one user; the existence of time delay and possible variations of this time. Technology of time-of-delay instability decreasing in local net with common carrier, providing allocation of priorities of the video information in comparison with other types of information, is offered. It will allow to connect local net of the enterprise to more extensive external nets' resources and to provide further development of informational maintenance of water cleaning and water preparation technologies on the basis of last achievement of science and technological progress.

OCEAN WATER DESALINATION

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Ocean is the main potential source of fresh water and for many countries in the world ocean and sea water utilization is almost the only way to solve the problems concerning vital activity of its peoples.

Total salt content in ocean water varies widely, it's average level is 35 gr/cub m and it increases in some regions, for instance in the region of the Red Sea it increases to 40 gr/cub m. Actually total salt removal from water is most likely an economic than a technical problem.

Modern methods of desalination:technologies of instantaneous boiling up, reverse osmosis and electrodialysis have changed the world completely. However ocean water desalination is still rather a complicated problem, the final solution of which is still the future deed.

Boron, probably, is the only main nd single element which content in ocean water makes to rack scientists' brains over it in many laboratories of the world.

Boron content in ocean water is from 2,0 to 4,5 mg/L[1] but standards of its content vary within the limits of 0,3-1,0 mg/L[2,3].

If one wants to make up one's mind to create something most inconvenient for desalination then it's difficult to imagine things more complicated than boron combinations.For instance boron acid is volatile with water vapor [4] that allows it to penetrate into distiller in units of instantaneous boiling up.

Spatial ion structure BO33- is in accordance with a flat equivalent triangle [d(BO)=1,35A]. Hydrogen connections among atoms of oxygen are also not so tight [d(OO)=2,71A].

For comparison d(H2O)=2,76A.

Thus if one follows the hyperfiltration theory, in accordance with which there are sufficient pores in semipermable membranes to allow water molecules to penetrate and to detain hydrated ions d>4A and more over - molecules, then reverse osmosis is almost good-for nothing concerning boron removal.

No doubt, with the existing level of knowlege it is possible to affirm that reverse osmosis is not exhausted only the hyperfiltrarion theory. There exist other impacts : sorption, electrostatics, diffusive; impossition or combination of which are the whole variety of real industrial processes of reverse osmosis, however it's evident that hyperfiltration factors dominate in the process that is the cause of a low effectiveness of reverse osmosis for boron removal.

Electrodialysis is based on another principles, nevertheless there are its own problems. The only requirement to removed compaunds in accordance with this method is dissociation in water and it is impossible to follow it here. Most boron combinations are slightly dissociated. There are of course variants of increasing of boron combinations dissociation, for example, due to fluorine introduction into desalting water but it looks more like a beutiful chemical game than a real desalination process.

In electrodialysis process size of particles'ionite pores varies within the other range, of course, under the condition that during the process of size reduction macromolecular net was not affected.For example,for ionite AB-17 average size of pores varies within the limits of 70A but ions' transportation is fulfilled by another mechanism.

Summarizing the above mentioned it's necessary to make the conclusion that at first approximatiom all the methods, especially membrane ones, are not sufficient for boron removal from water.

Taking into consideration the above mentioned one has to keep in mind any affects which can change boron combinations in water in any way and to make processes more effective.

Thus they receive the following condensate content at one of the enterprises: pH-5,2-7,5; boron-3,2 mg/L; sodium-0,24 mg/L;

potassium-0,13 mg/L; Chlorine-ion 0,2 mg/L; sulphate ion < 0,1 mg/L.

It's clear that water after boron removal may be used both for technical and drinking needs.

We've studied perculiarities of electrodialysis using model solutions of boroncontent water with average boron content-3,6 mg/L.

It is settled that electrodialysis with the standard membranes MA-40 and MK-40 is quite uneffective. Within the limit of error of an experiment with the standard current strength boron passage is 100%. Only use of special membranes and special design of electodialysis [5] gave a positive result, which allows to remove boron within the range of 82-96 %.

Residue boron concentration in dialyzate was 0,37-0,65 mg/L with reverse of hydraulic flow and direction of current each hour.

In 1996 we are going to conduct continuous two-month tests of our new technology.

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MOTIVATION AND WAYS OF SOLUTION OF PROBLEMS OF IMPROVEMENT OF DRINKING WATER SUPPLY TO THE POPULATION OF RUSSIA

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Water supply of residential locations in the Russian Federation is maintained using mostly surface water sources, which constitute 68% of the total amount of water supplied to the population. It is this type of water sources that are mostly exposed to unfavorable anthropotechnogenic factors, such as: discharge of untreated or inadequately treated wastes (the amount of waste waters treated according to the existing standards is only 9%),massive contamination from the atmosphere and agricultural fields, secondary contamination also due to biotransformation of contaminated water reservoirs' bottom sedimentation.

As result of practically unregulated intensive contamination only 1% of surface water sources belong to the 1-st class, for which traditional technological schemes of water preparation are meant. Often secondary contamination of drinking water takes place in pipe-lines with 40-50% wear.

It is mainly the mentioned above circumstances that predetermine the fact that in the whole country every fourth drinking water sample does not meet the hygienic requirements according to sanitary-chemical indices, and every nineth - according to bacteriological indices. of the existing GOST 2874-82 "Drinking Water", according to which up to 28 indices are controled. It has been shown that the percentage of samples not meeting the international requirements in accordance with the latest WHO recommendations on drinking water quality control (1993)is still significantly higher.

Urgent measures for the improvement of centralized water supply on the federal level are as follows: establishment of enterprises producing in sufficient amounts the necessary reagents, materials, equipment (at present only 70-90% of the need in chemical reagents is met, 40-50% - of the need in materials and equipment, enterprises producing high-quality corrosion-proof tubes practically do not exist); development of an efficient drinking water quality monitoring system and production of up-to-date analytical equipment; paying more attention to the high priority scientific developments and development of normative-legislative documents; regulation of the price policy on water for industrial and house-hold-utility spheres taking into account social protection measures.

The priority tasks of water-supply canals are as follows: ensuring the presence of a complete set of

equipment at the water-line network (33% of communal water-lines lack the complete set of water treatment devices), ensuring total coverage of urban population by centralized water sypply (1% of cities does not have centralized water supply); banning the functioning of water treatment installations with deviations from the technological procedure and the ones working in the regime of hydraulic overload; ensuring of timely replacement of the water-lines lay-out; transfer to the use of more protected from contamination underground waters (at present they constitute only 32% of the total amount of water consumption); more strict control over discharge of emergency and insufficiently treated wastes into water sources (more than 30 km^3 annually); active implementation of new technologies of water treatment.

The critical canitary-ecological state of water sources - surface water sources and water-lines in a number of regions of the country in particular, more frequent cases of acident (and sometimes emergency) situations, inertial character of spreading of contaminations predetermine, alongside with the mentioned above factors, development and implementation of rapid administrative measures for the improvement of drinking water quality, formation of recommencing strategic reserves of water. Such measures include portable (individual,domestic, group) devices of the guaranteed final treatment and final disinfection of tap water, development of the production of of high-quality bottled waterA special place in the system of these measures is occupied by regional devices and waters, not only preventing any contamination, but also conditioning the drinking properties of water in relation to the indice of its physiological adequacy (e.g., with an optimal for the organism fluorine and other essential elements content). The most importanrt federal measure for the rapid solution of an urgent problem of the improvement of drinking water supply in Russia would be making the production activity aimed at the improvement of "health"of the water factor tax-free or with a limited taxation rating.

WORKING OUT OF METHODICAL FOUNDATION OF SEARCHING AND ASSESSMENT OF NEW WATER DESINFECTION WAYS

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At present the problem of water desinfection acquires peculiar urgency due to the limit of fresh water and increasing contamination of natural reservoirs. Traditional method drawbacks make specialists search for new ways based, as a rule, on the combined action of two or more factors.

Our work is aimed at wording out of methodical foundation of searching and assessment of new water desinfection ways. The results of the work are presented as a conception based on three principles: complexity, versatility and methodical systemity.

The first principle, i.e. complexity, envisages the use of hygienic, technical and economical and ecological criteria on estimation of a new water desinfection way.

Hygienic criteria of drinking water quality, disinfected by any way, include achieving acceptable organoleptic, microbiological, physical and chemical quality indices as well as the absence of both nearest and distant unfavorable effects while using disinfected water. Epidemic safety of disinfected water must be provided by achieving the established efficacy, that is destruction of vegetative and spoors microorganisms, nematode eggs and pathogenic protozoa. absence of reactivation phenomenon being the sign of safety.

Technical and economic criteria include effectiveness and simplicity of control over the process of desinfection, the presence of ready decisions on the problems of technological equipment creation, simplicity of technological scheme and compatibility with other types and ways of water treatment, equipment productivity and it's safety for the staff.

Ecological criteria envisage the absence of nearest and distant unfavorable effect on population and environment health.

The second principle, methodical systemity, suggests total combination and succession of assessment stages including the use of standard water models; modeling of water contamination with standard test-microorganisms, viruses, bacteriophages, pathogenic protozoa; evaluation of organoleptic physical and chemical disinfected water indices; carrying on step-by-step experimental investigations on assessment of the biological action of treated water (bacterial cell - hydrobyont - experimental animal -human -being); taking into account possible transformation of substances during water desinfection; effectiveness of desinfection in natural conditions.

Suggested methodical approaches were tested while combined assessment of new way of drinking water desinfection, i.e. the use of low-voltage electrohydraulic effect.

NEW SYSTEMS OF DRINKING WATER QUALITY CONDITIONING AND THEIR HYGIENIC ASSESSMENT

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The twentieth century is marked by a wide-range use of centralized drinking water sypply of residential areas, which historically was associated, first of all, with high antiepidemic efficiency of most commonly used means of its disinfection (chlorination, ozonation, ultraviolet irradiation), as well as with a significant barrier role of processes of water coagulation, settling and filtration in respect to parasitic diseases pathogens and parameters determining its organoleptic properties (first of all, turbidity and colour).

Alongside with this, rapid technical-economic development and insufficient nature-protective activities have resulted in such intensive technoanthropogenic contamination of water sources that the existing schemes of water preparation appeared to be insufficient for obtaining of good-quality drinking water by the consumer. This predetermined three main ways of solution of the problem:

- using more stringent measures controlling contamination of water sources,
- up-dating technologies of water treatment at waterworks,
- deep final treatment of tap water directly at the place of its consumption.

For many residential areas in Russia the last way is the most fast and reasonable for the nearest future.

It is common knowledge that the first portable devices for final treatment of tap water were of regional character and they solved a limited number of problems (as a rule, the improvement of organoleptic water properties, decreasing the content of organic substances in it).

Water treatment devices of the second generation created in the Russian Federation in recent years, such as BIP (for individual use), Barrier-3, Priboy, Izumroud (for domestic use), FKP, ROSS, BUMO, ELFOTEH, VIAM (for group, collective use) are characterized by a high degree of reliability, large resource(in relation to the task) and comprehensive treatment, which enables to make a guaranteed disinfection of water removing parasitic diseases pathogens, bacterial and viral infections pathogens, to significantly improve its organoleptic properties, to remove the major chemical contaminants of both organic and inorganic origin.

Third generation portable devices of comprehensive water treatment are aimed at providing not only such major criteria of water quality as its epidemic and radiational safety, harmless chemical content, favorable organoleptic properties, but also at providing physiological adequacy of the treated water. Therefore, the minimal necessary levels of total mineral content, hardness, alkalinity, the content of certain biogenic elements (calcium, magnesium, fluorine etc.) in water have been scientifically substantiated in the Russian Federation.

Taking into consideration the physiological adequacy criterion portable water treatment devices-fluoriners of the Topaz and Barrier-5 type were designed for the first time, which make it possible not only to treat water deeply, but also to optimize fluorine content in it to prevent dental caries.

Hygienic assessment of water treatment devices of the third generation has shown that they not only efficiently (down to hygienic standards) remove metals (lead, cadmium, chromium, iron, copper, zink, manganese), chlororganic compounds (trihalomethanes), phenols, detergents, benz/a/pyrene, arsenic, active chlorine with the initial content at the level of 2 MACs, and significantly improve organoleptic properties of water throughout the whole resource (500 litters), but also provide for conditioning of tap water up to the optimal levels 0,9 - 1,2 mg/l as far as fluorine is concerned in the most typical for Russia regions (I,II,III climatic zones).

Studies have shown, that additional administration of biologically essential elements into water in biogeochemical areas deficient in those elements , is an exclusive prerogative of portable devices of comprehensive water treatment according to reliability and economical parameters, their social effect being equal to that of the highest priority therapeutic and, which is still more important, preventive medical means. Therefore, devices are being developed which would optimize the content of such physiologically important elements as calcium, magnesium, iodine, selenium in water.

STEP-BY-STEP CERTIFICATION OF PORTABLE WATER TREATMENT DEVICES

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Examination, ecohygienic assessment and certification of portable water treatment devices (PWD) are the most important conditions for their use and are carried out by organizations, accredited in the system of the State Committee on Sanitary and Epidemiological Surveillance of RF and State Standard of RF for carrying out such studies.

In general the methodological scheme of carrying out studies on PWD for their certification should include seven major stages:

Ist stage - analysis of the initial documentation and hygienic examination of reagents and materials used in the device with the aim to determine the necessary scale of studies (within the program of testing of the universal or regional filter, need in additional studies of new reagents and materials etc.).

2nd stage - ecohygienic study of new reagents and materials used in PWD. Results of the second stage can be as follows: a) - positive assessment with inclusion into permission documents (with or without restrictions); b) - negative assessment with cessation of testing of the device; c) - operative replacement of the device (in case of negative assessment) by a similar one which is permitted; this stage is included into the general scheme either if new reagents and materials are used or if permitted reagents and materials are used, but under aggravated conditions.

3d stage - ecohygienic study of PWD safety taking into account complex exposure to various reagents, materials and processes. The major results of the stage:

substantiation of complete safety of PWD during the whole resource, determination of the necessary time (volume) of the washing, washing out and regeneration cycles, resource limiting according to the safety indice or specification of the program of studies at the 5th stage.

4th stage - study of the barrier function of PWD in relation to biological and chemical contaminations under the conditions of resource testing, which makes it possible:

- to assess and give a quantitative evaluation of water disinfection and treatment with an account for kinetics of the treatment process;

- to determine the category of the water treatment device (for disinfection and treatment of water sources, for final disinfection and final treatment of tap water, for regional (specific) use , for universal conditions of utilization, for desalination and treatment of water etc.);

- to detect negative side effects, on the basis of which to give restrictions for the conditions of their use or to give negative assessment of PWD.

5th stage - studing (if necessary) of hygienic efficiency of using PWD in emergency situations. On the basis of studies and taking into consideration possible emergency situations an area of the possible additional use of PWD is identified: for water treatment with a specific purpose, for the complex treatment and disinfection of water, for specific (military and other) purposes.

6th stage - making documents on hygienic certification of PWD and their hygienic certification in Centers accredited for these porposes by the State Committee on Sanitary and Epidemiological Surveillance of RF. Results of this stage could be as follows: PWD safety certificate on an experimental group of devices or on mass-produced devices, additional examination in relation to special issues.

7th stage - making documents for certification in the system of the State Standard of RF and compliance certification within the State Standard system, which gives the right for PWD to be distributed in the commercial network.

The proposed step-by-step scheme of carrying out studies on PWD in the GOST certification system makes it possible to study the barrier role of PWD in resource tests to a sufficient degree with respect to various types of biological and chemical contaminants, to determine quantitative indices of water treatment efficiency at the end of the tested or recommended on the basis of carried out testing resource(filter-cycle), to specify the restricting conditions (if any) for the use of PWD presenting its negative characteristics, which, on the one hand, should be known by the consumer, and on the other - is the basis for the possible modernization of this or that PWD.

MEMBRANE FILTER PRESSES FOR DEWATERING SLUDGES FROM POTABLE WATER TREATMENT PLANTS

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Background.

For many years recessed chamber filter presses have been well established technology for dewatering sludge from all manner of industrial and municipal water treatment processes. The simple operating principle and the high dry solids concentration of the filter cakes have proven advantageous compared with lower capital cost, continuous dewatering processes.

In recent years several developments have led to the need for improvements in the performance of many of these existing plants:

- increasing water demand, leading to higher sludge quantities.
- increasing numbers of water conditioning chemicals, making operational flexibility in the dewatering plant a must.

Potential for upgrading existing plants.

Increased throughput of existing chamber filters can be achieved by improving feed concentrations by mechanical thickening and by using synthetic polymers either in the thickener or in the dewatering process itself.

Recent developments in membrane filter press technology, coupled with the above, can provide capacity increases of typically 50-100% and improvements in filter cakes by 3-15% DS, depending on sludge characteristics.

The paper details some of the plant upgrading projects undertaken by the authors company, including the design changes and performance improvements attained.

Application to new facilities.

An outline of the available sizes and features of recessed chamber and membrane filter presses is provided, together with a summary of performance on various sludge types, as a basis for preliminary sizing of dewatering facilities.

The use of mobile or temporary facilities for dewatering sludge accumulated in lagoons and the application of membrane filter presses for industrial water treatment sludges are also discussed.

THE EXPLORATION OF THE BARRIER ROLE OF THE WATER TREATMENT FACILITIES RELATED WITH PARASITIC DECEASES EXCITES

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Used in the centralizes water supply system of residential areas water treatment includes initial settling, coagulation, settling, filtration and decontamination wit gaseous chlorine. Sorption, oxidation-sorption methods of treatment and decontamination by ozonation are used in a few water pipelines. Underground water usually get to the waterworks without any pretreatment or after desinfection by chlorine only.

The study of the barrier role of the water treatment facilities as examples of centralized water waterworks systems in Khabarovsk and Khabarovsky region, Moscow, Astrakhan, Upha shows that existing water treatment facilities doesn't provide effective cleaning of water from parasitic diseases exiters everywhere (in Khabarovsk and Upha 96.9-98.5%, in Moscow - 100%).

The main reason for incomplete drinking water cleaning from enteric pathogenic protozoa cysts is low dose of coagulant (less than 5 mg/l), being used for water treatment.

The presence of parasitic exiters in drinking water cause its epidemiology danger in spreading of parasitic diseases in the population.

It shows the necessity of permanent monitoring for quality of drinking water and modification of technological processes in the centralized water supply system of residential areas. Furthermore, the results of exploration are formed the basis for study of drinking water influence to spreading of parasitic deceases in the population, and also for target development and implementation into practice some new effective water treatment facilities.

SANITARY-PARASITOLOGIC CHARACTERISTICS OF THE DRINKING WATER SOURCES

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During the 1988-1995 we carried out special sanitary-parasitologic studies of water in rives Amur, Amgun, Bira, Amur (Khabarovsk region), Volga (Astrakhan), Moscow (Moscow), Tchara (Grodno region), Dnestr (Odessa region), Belaya (Ufa), Syr-Darya (Leninsk, Kazakhstan) and some lakes in the Grodno region, being sources for drinking water supply.

Parasitic deceases exciters (cyct of Giardias, balantidium, oocysts of cryptosporidium, eggs of askarides, trichocephalos, toxocar, opistorhides, diplfyllobotrides, teniid) were detected in all checked objects.

Many years of studies shows that it quantities are in wide range and depends from season. As the result of monthly observations in 1991-1995 at Volzhsky and Moskvoretsky water sources is found that maximum of concentration was observed in the winter (55-75 Giardias cysts per sample), but in the summer - not more than 2-16.

The significant decreasing of water contamination by enteric parasitic agents was marked from the middle of 1994 and during whole 1995: in the Moskvoretsky source doesn't exceed 6-7 and at Volzhcky source - 1-2 per sample. It's caused by execution of complex water treatment actions and small amounts of atmosphere sludge which decreased receipt of contamination with drops from outside areas.

During the investigation of sanitary condition in underground water sources Giardias cysts were detected in artezian water, getting from chink with depth of 80-120 meters in 1992 near city Slonim (Grodno region) and in 1993 - near city Novopolotsk (Bryansk region). This event has been observed in cases depth water horizonts were not protected from penetration of ground water.

Basics ways of enteric parasitic exiters getting into surface water are drops of waste in populated areas, animal drains, and also surface flowing off from farms. Besides that, in the time being the role of water animals (beaver, musk rat) as sources of human enteric parasitic exiters and participation into contamination of water facilities by Giardias cysts and Criptosporidium oocysts can't be excluded. The detection of enteric parasitic exiters in surface and underground water makes it epidemically hazardous and indicates to possibility of its participation into the spreading of parasitic diseases among the population.

It should be taken into consideration in the development and construction of water treatment facilities and during preventional sanitary monitoring for its work.

KRASNOYARSK DRINKING WATER CRITICAL INDICES AND WATER SUPPLY MODERN TECHNOLOGIES

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In accordance with the conception [1] in 1991 - 1995 there were provided the systematic study of drinking water and river Yenissey quality (in the area of water wells) for 89 indices. The most part of which was defined in "Guidance for the control of drinking water quality" (World Health Organisation).

The investigations were provided in the following directions:

- surface water quality estimation and project development of sanitary protection of the second zone wells with 72 km lenght;
- drinking water quality estimation in accordance with the state standarts 2874-82 and sanitary norms and standarts 4630-88;
- drinking water quality estimation for enlarged list of indices in accordance with the project of the state standart "Water quality. Drinking water. Quality control";
- the detection of critical indices and development of modern water supply technologies.

Having more that 50 thousands of measurements the data-bank has been got. Data-base analysis for some years allowed to obtain as average statistical data, as both annual and seasonal. The integral estimation of drinking and surface water quality was also provided. The following critical toxicilogocal indices were detected: silicon, benz(a)pyren, phenols, chlororganic compounds. The forms of silicon compounds in drinking water were also studied.

There were provided comparative investigations on nature sampls on phenol concentration determination by gas-chromatografical methods and

by state standarts methods. It was shown that the last one does not correspond to international standarts both in sensitivity for getting trustworthy results for phenol concentration.

The indices of oil-products and oxidability are very close to critical on the well "Gremyachi Log" where water is practically taken from the surface source. In that area during spring-autumn periods has been mentioned the sharp deterioration of filtration facilities operation because of large quantities of phytoplankton in the outcoming water - up to 36 thousands cell/ml.

Regarding these results there were concidered some technological devices, which allow to get drinking water of demanded standarts:

- the change of ceramsite-sand charge for natural zeolite (clinoptilolite) having both sorption and cation exchange qualities, it also can be used as additional step of treatment from ionic admixtures;
- interduction of ozone for different steps of treatment;
- combine application of ozonation and sorption methods to provide drinking water reliable protection from ozonation by products.

Zeolite deposites Holinski, Sakhaptinski and Pashenski have been studied. All the zeolites reduse the concentration of above mentioned impurities, but according to technological parameters (mechanical induces) only Holinski zeolite deposite is acceptable.

Ozone flotation showed successfull results conserning plankton quantity elimination (60 %), ozidability and benz(a)pyren and phenols concentration reduction.

It was discussed the usage of local cheap browncoal sorbents BC and graphite sorbent SGN-30.

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HALOMETHANES AND OTHERS CLOROORGANIC SUBSTANCES IN DRINKING WATERS. FORMATION MECHANISMS AND WAYS OF ITS DECREASING

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Surfaces waters of Russia due to geographic and climatic peculiarities contain more organic impurities in comparison with medium European level. Traditional desinfection of it by chlorine or related compounds lead to formation of significant quantities of halomethanes

(THM) and unvolatile chlorinated derivatives (AOX). Well known harmfull consequences of action of this compounds on people are compelling to search methods of decreasing it contence in waters, in first turn used for drinking.

Our research showed that formation mechanisms of THM and AOX are different. THM are forming as final result of long transformation chain of organic substances. The reaction consecution was studied on the acetone and phenol as examples. Integral resemblance with this models shows humic and fulvo acids. The comparison of THM formation mechanisms with the influence usual water treatment stages on THM yeld give an reasonable explanation of weak response on some changing in technology.

AOX are forming, basicly, as a result of straight chlorination of primary molecule of impurities. Secondary products react slower. Therefore AOX yelds more essentially depends on used technology of water treatment and year seasons, than THM.

Taking into account the especially of THM and AOX formation allow us to decrease its contensein purified and disinfected waters.

DIOXINS FORMATION POSSIBILITIES IN THE PROCESS OF DRINKING WATER CHLORINATION

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Among the grate amount of chemical substances containing in water objects special attention is paid to polychlorinated dibenzo(p) dioxins (PCDD) and dibenzofurans (PCDF). Tetrachlordibenzodioxins (TCDD) - the most toxic substances, are at the head of these compounds. The main threat of 2, 3, 7, 8-TCDD is the cronic affect and distant consequences in small doses.

There are a lot of large-scale industrial enterprises on the base of chlororganic synthesis in Ir-

kutsk region. They are - Chimprom (Usolje-Sibirskoe, Sayansk), paper-mills (Baikalsk, Bratsk, Shelekchov), metallurgy enterprises (Shelekchov, Bratsk) etc. - potential and (or) real sources of dioxins formation. Their main location is along Angara river, its reservoirs and accordingly, their sewage thrown down the drinking water source. Pollution possibility of Angara river by polychlorinated compounds (PCB) at the expense of surface flowing from agricultural fields, treated with aminic salt 2-4 D and other chlororganic pesticides is not excluded.

According to the situation ther is an obvious necessity for hygienic evaluation of drinking water in Angara river for PCB maintenance, finding out the conditions of dioxins formation in chlorinating process on water stations.

Dioxin definition in water was carried out according to the EPA US 1613 methods with previous benzene extraction, clean-up procedure with the help of preparative column chromatography and fractionation on aluminia oxide.

Isomerspecific analysis was carried out using the "Hulett-Paccard"HP 5890

(series 2) chromatograph and MSD-5982 mass-selective detector in regime of selective detection of molecular ions.

Water quality was analised for chlorfenols and dioxins maintenance at all stages of drinking water preparation during the chlorinating process.

Preliminary results are obtained. They indicate to increase of pentachlorfenol in water from 0,05 mg/l on the first altitude station to 0,15 mg/l in water network. At the same time corresponding alterations of dioxins level from 2,0 pg/l to 7,5 pg/l on the exit were found out.

In future we intend to estimate the parameters and conditions, caused polichlorinated organic compounds formation.

ELECTROCHEMICAL TECHNOLOGIES AND EQUIPMENT BY RESEARCH AND PRODUCTION ENTERPRISE "SANER" FOR PREPARATION OF DRINKING WATER AND WASTEWATER DISINFECTION

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Clorination, traditionally, occupies the leading position among the well known oxidize methods of water treatment in world practice, in particular, the treatment by solutions of sodium hypochlorite, obtained from sodium chloride solution in different electrolysis apparatus.

As a rule, the chlorination points at economical objects in our country are rigged by obsolete, unperfect equipment, which do not allow to obtain chlorination solution of good quality, and thifact prevents to the development and broadcasting of this significant and inexpensive, in comparison with others, methods of chlorination.

Research and Production Enterprise "Saner" has developed and produces the series of electrolysis sets with various capacity. These sets are allow to obtain sodium hypochlorite right at the point of consumption and they are destined for different consumers from small medical laboratories, which use the low capacity sets for quick preparation of sodium hypochlorite, as disinfection agent, for large enterprises.

Perfection and creation of pure ecological technologies, development of equipment, cooperation with some organizations which specialize in chlorine manufactures (in particular enterprise "Cation"), series outlet of developed equipment well provide for reliable chlorination with adding conserve properties to treating water (stability to second infection) with its minimum mineralization, and use of sets:

- at the objects of water preparation and water use;
- in wastewater disinfection (including wastewater from tinctorial and galvanic manufactures, wastewater with organic substances and etc.cet.).

The results, obtained after a long exploitation of electrolysis sets "Saner" in industry, allow to make a positive estimation to the perspectives of their future perfection and use in water treatment.

INDUSTRIAL AGGREGATE WATER UTILITY BALANCE

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The Ural region economy aggregate is characterized with the shortage of water resources that influences on industry, agriculture and social sector. The utilization of water supplying objects as wastes collectors, unbalanced distribution flow existing in time and on the territory, not rational utility of water resources and others are considered to be the reasons of water deficit.

New water supplying sister approach for industrial complex based on the water use balance

which provides future water needs due to internal water technology sister volumes was suggested. The water use balance is a omparison of suitable water volumes with resource needs and analysis of income and consumption balance parts for overcoming of water volume deficit originated from different reasons.

The specific of the work considered is that introduction of water use balance sister results in general wastes volumes decrease, following by stabilization of treatment plants capacity, quality of waste treatment improvement and antropogenic influence on natural objects mitigation. Moreover water utility balance ensures protection and prevention of natural objects from pollution and exhausting.

The implementation of water utility balance approach allows to escape from new constructions of fresh water supplying objects and improves the reliability of water supplying sister due to the local water resources. Methods of implementation includes the development of objective complex programs on rational water utility in industrial agglomerates which covers all the levels of water supplying system management beginning with the technical devices to general operation

Scientific base for specialists disciplinary working group forming was advanced for implementation of water utility balance system. Technical actions approving the diminishing of wastes volumes at the city waste treatment plants were determined.

The first steps of approach application were done in Nighnii Tagil industrial agglomerate with the help of objective complex program of rational water resource utility. The improvements of water utility mechanism were done in Kamensk-Uralskii and Pervouralskii industrial agglomerates.

Technical parameters: the ability of wastes decrease from 30 to 50 %, practical conditions of water utility balance implementation in any industrial aggregate. Water utility balance performance allows to discharge from the construction of new water supplying sources. The main directions of the work have been published in the book: Safronov E.V. and others, Water utility balance of Pervouralskii industrial agglomerate, Sverdlovsk. Published in the Ural Polytechnic Institute, 1991. p.200

Potential consumers of the work-industrial agglomerates administrations with the population up to 600.000 people, water supplying firm administrations, environmental committees, academic institutions, municipal administrations.

FERROMAGNETIC SORBENTS ON THE BASE OF NATURAL ZEOLITES FOR PURIFICATION OF THE HIGH TURBID SOLUTION

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Introduction

The total pollution of the environment (water, silts, soils) with heavy metal, radionuclides and organic pollutants requires the development of the inexpensive and readily available methods of purification.

The natural zeolites are used for purification of surface, underground and waste waters. However the filtering becomes more difficult when the waters and solutions contain much of suspended solids. The purification can be performed only in limited volumes in this situation. It is possible to achieve the subsequent effective phase separation (sorbent, suspended solids and solution) using the sorbents, which possess magnetic properties.

The aim of this work was the producing the ferritized sorbent base d on the inexpensive natural ion-exchangers, and investigation of their characteristics in the processes of purification of the waters and solutions with high sludge content.

Materials and Methods.

The clinoptilolite containing tuffs from various deposits (Tedsamy-Georgia, Kholinskoe -East Siberia, Bely Plast- Bulgaria, Stone House - USA) were used as initial materials with different clinoptilolite conent (60-80 %) and different granulometric composition. The ferritization conditions were chosen according the magnetic susceptibility and magnetite content in the material obtained. The dependencies of these characteristics on various parameters were investigated and ferritization conditions were optimized. It is worth noting among these factor solution concentration , temperature, contact time, particle size of clinoptilolite, its initial ionic form, ratio of magnetic matter and clinoptilolite /1/. The ion-exchange properties of magnetic sorbents were estimated on the static ion-exchange capacity and on distribution coefficients for Cs and Sr from solutions, imitating surface, underground and waste waters. Also some industrial waste waters were investigated (Chelyabinsk, "Mayak"). The kinetic properties of the sorbents were studied on the strontium sorption using thin layer technique and also using comparable dynamic break-through curves.

Results and discussion

The materials with high magnetic characteristics were obtained. Their magnetic properties do not depend on the clinoptilolite content in the rock and on phase composition of tuffs.

The investigation of ion-exchange characteristics of magnetic clinoptilolite showed that the magnetic sorbent retained the ion-exchange capacity and selectivity of the initial clinoptilolite (as to the sorption of cesium and strontium ions). It was shown also that the rate of strontium sorption by the magnetic sorbent was higher then by initial natural materials.

The study was carried out on the recovery of heavy metals from water and sludge by magnetized clinoptilolite.

The data obtained demonstrated that it is possible simultaneously to purify water and sludge from the metal pollutants (radioactive strontium and cesium and also chromium, cobalt, copper, etc.).

Thus the results obtained indicated that magnetized clinoptilolite can be employed for simultaneous water and sludge purification from radionuclides and heavy metals.

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ELABORATION OF COAGULANTS TECHNOLOGY ON THE BASE OF ALUMINIUM HYDRROXOSALTS AND THEIR APPLICATION IN WATER-SUPPLY SYSTEMS

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The results of investigations in the fields of: aluminium hydroxosalts synthesis and new varieties of inorganic coagulants on their base as well as physico-chemical properties reagents obtained studying; elaboration of technological methods and all normative-technical documentation necessary for their industrial realization; designed and assembly work implementation; testing of coagulant samples consumer properties in real conditions at one of the municipal water purification plant in Ekaterinburg are presented in this article.

Among the technologies best known in water purification practice reagent method that make use of aluminum sulphate takes the leading place in Russia. However, when using only one coagulant it is difficult it meet evergowing requirements to water treatment as water in surface sources (rivers, lades, water, reservoirs) that are used for drinking water preparation is subjected to some changes including seasonal, nature-climatic changes as well as those conditioned by industrial and domestic contaminations.

Theoretical foundations of a new trend in technology of coagulants on the base of aluminium hydroxosalts ensuring wide enough chemical reagents assortment production for natural water treatment that meets all standard requirements valid for a year were elaborated.

Realization of above mentioned method of coagulant production at the "Urals-coagulant" enterprise (Pervouralsk) makes it possible to insure water preparation system of the Ural region with effective inorganic chemical reagents.

For the first time in condition of seasonal water quality changing comparative evaluation of a series of traditional and new coagulants as well as those received from different firms of Germany, USA, Hungary was carried out. These tests were being carried out from April 1994 till September 1995, special attention paying to activity of coagulants in summer-autumn (August-September) and spring high water (April-May) periods.

Initial water had the following characteristics: 2-20°C; colo- ured indicator - 85-100; alcalinity - 0,9-1,2 mg eg/l; turbidity 1-4 mg/l; pH 6,4-7, Fe 0,801,2 mg/l depending upon season.

Water solution of hydrochloride-sulphate and aluminium chlorosulphate with different molar correlation $Cl:SO_4$ and OH:Al, varying in a wide range were the objects of investigations. The dose of reagents was varying from 5 to 20 in terms of Al_2O_3. Water analysis was carried out according to main indices nomenclature that was defined by drinking water standard (ГОСТ 2874-82).

The analysis of comparative investigation data and theoretical calculations of coagulation processes principal parameters helps us to determine some regularities and peculiarities of water purification process in these conditions and come to a simple conclusion as concerns the effectiveness of new coagulants on the base of aluminium hydroxosalts.

INFLUENCE OF SOME FHYSICO-CHEMICAL AND TECHNOLOGICAL PARAMETERS ON THE CONCENTRATION OF FLUORINE IN WATER WHILE USING FLUORINE-CONTAINING COMPOSITIONS FOR FLUORINE WATER CONDITIONING IN HOUSEHOLD

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Today caries is one of the most common diseases affecting health status of the population. Alongside with this, it has been proved that it is water fluorination that is not only the most effective way to decrease dental morbidity in children, but that it can also prevent caries in adults.

At present more than 70% of the population of Russia live under the conditions of fluorine deficiency, which is why one of the most rapid and optimal from the technical and economic points of view means of solution of the problem of providing the population with fluorinated drinking water is development and wide use of small-size devices for drinking water fluorine conditioning which would be available for the population at large.

The authors together with the joint-stock company METTAM have developed small-size domestic water treatment devices with a dosed fluorine discharge into the water (water treatment devices-fluoriners). One of the main components of the filtration material of those devices is granulated fluorine-containing composition (granulate).

Our work was aimed at studying the efficiency of tap water fluorine conditioning using fluorine-containing composition depending on different phisico-chemical parameters of the initial water. The most interesting out of chemical parameters is the effect of the level of natural fluorine ion content in the initial water on its isolation from the artificially made granulate. The method used was as follows: the initial water with different levels of fluorine ion went through a granulate layer with registration of fluorine ions in the filtered water. Potentiometric method utilizing fluorine-selecting electrode was used for determination of fluorine concentration in water.

Data analysis has shown that with 0.2-1.2 mg/l fluorine concentration in the initial water its concentration in the filtrate was stable equalling 1.1 ±0.2 mg/l. With fluorine concentration in the initial water on the level of hygienic standard (1.5 mg/l) and higher fluorine concentration in the filtrate stopped increasing and was the same as its concentration in the initial water. It is possible to make a conclusion on the basis of the obtained data that a balanced fluorine concentration for such a heterogenous system under the studied conditions will not exceed 1.1±0.2 mg/l, which provides for a stable fluorine concentration on the level of its optimal content in drinking water for 1 or 2 climatic zones.

As is known, conditions of chemical equillibrium can be also influenced by physical factors of the initial water. Investigation of temperature influence on the heterogenic system containing 5 grammes of granulate in distilled water has shown that the intensity of fluorine ions getting into water changed insignificantly at the temperature 20±10°C, but with the increase of temperature up to the boiling point it increased 10 times fold.

Studying of the dependence of fluorine concentration in the filtrate on the filtration rate has shown that with the increase of the rate from 50 ml/min up to 600 ml/min, i.e. more than ten times fold, fluorine concentration in the filtrate became only three times less. With the filtration rate within 100±20 ml/min and initial water temperature 20± 10°C fluorine concentration in the filtrate was the same during the whole tested resource of the filter with fluorine-containing composition (500 l).

Thus, on the basis of the obtained data a possibility of modeling of vrious domestic and group devices for water conditioning according to fluorine taking into account regional standards for different climatic zones has been substantiated.

CHARACTERISTICS OF HYGIENIC EFFICIENCY OF DOMESTIC WATER TREATMENT DEVICES- FLUORINERS

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Drinking water fluorination is a necessary and most efficient prophylactic measur against caries. Hygienic assessment of the efficiency of using domestic devices for water quality conditioning was made based on the use of a specially selected fluorine-containing reagent with a certain kinetics of discharge of fluorine ion into the water, granulometric content and hydrodynamic properties (determining filtration rate), which makes it possible to optimize fluorine content in drinking water in accordance with hygienic requirements in the process of the most rational variant of conditioning (fluorination) of limited amounts of water used only for drinking and cooking.

Taking into account that the problem of water fluorination might not be the only one as far as its

quality improvement is concerned (presence of chemical and microbic contamination in it) various types of domestic water treatment devices-fluoriners were developed which combine fluorination and final water treatment removing chemicals ("Topaz-02", "Barier-5L"), as well as its disinfection ("Topaz-03"). Comprehensive hygienic assessment was carried out in accordance with Methodological Recommendations for Eco-hygienic Assessment of Domestic Water and AirTreatment Devices, developed in A.N.Sysin Institute of Human Ecology and Environmental Health, RAMS (1995).

Hygienic assessment of the possibility of migration of toxic chemicals from a complex of construction materials and from the filtration material did not detect any negative changes in the treated water quality according to hydrobionts bioassays and physico-chemical studies results.

Study of the efficiency of fluorine drinking water quality conditioning using the mentioned above devices showed that they provided for the optimal fluorine concentration in water on the level of 1.1+0.2mg/l persistently (in the process of the whole resource).

Resource testing of the efficiency of the functioning of domestic water treatment devices-fluoriners in final water treatment removing various chemical (organic and inorganic) contaminants (following administration of them into the initial waters on the level of two MACs) showed that the tested devices provide for efficient removing of heavy metals: iron - 54-74%, copper - 70-77%, zink - 67-72%, manganese - 65-68%, cadmium - 75-79%, lead - 72-77%, cobalt - 60-70%.

Assessment of the efficiency of organic substances sorption showed that the effeciency of removing of the most common drinking water contaminants - halogen-containing compounds formed as result of chlorination, and in the first place of chloroform with the initial level of it of up to two MACs was 63% (Topaz-03") and 80-88%("Topaz-02"and "Barier-5L"). Efficiency of phenol removal using all devices was 75-90%. The degree of removal of petroleum products and surface-active substances was also rather high (40-60% and 60-73% respectively).

Analysis of the quality of water obtained from water treatment devices-fluoriners according to organoleptic parameters made it possible to note that during the whole resource efficient removal of odour with the intensity of 3-4 points was ensured, turbidity also became 80-93% less, colour - 50-60% less - the initial values being on the level of hygienic standards. High efficiency of residual active chlorine removal (87-95%) was observed with the initial content 1.2-2.4 mg/l.

Study of the efficiency of the fluorinating water treatment device "Topaz-03" which is also meant for final disinfection of drinking water showed that the treated water met the hygienic requirements of GOST 2874-82 "Drinking Water" as far as bacteriological parameters are concerned following treatment of 400 L of water with the initial contamination according to coli-index up to 10^3 BJEC/L and TMC-up to 10^3 m.b./l. According to additional parameters (conditionally pathogenic bacteria with all studied contamination levels(for Salmonella - up to 10^1 cells/l, Clostridia - up to 10^2 cells/l and Pseudomonas aeruginosa - up to 10^1 cells/l) 100% efficiency of water disinfection was reached. Virucide effect of "Topaz-03" was characterized by 100% inactivation of coli-phages and enteroviruses.

On the basis of results of complex hygienic assessment domestic fruorinating water treatment devices were certified and a permission was given for conditioning as far as fluorine is concerned, final treatment, and in the modification of "Topaz-03"also for final disinfection of inadequate water from centralized systems of utility-drinking water supply.

TECHNOLOGICAL ASPECTS OF PURIFICATION AND BACTERICIDIAT TREATMENT OF DRINKING WATER BY FAR EASTERN ZEOLITES

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During the last time natural sorbents are widely used as filtering matirial for purifuing of drinking water [1], for purifuing waste water of industrial and food enterprises [2]. In earlier investigations we showed that the modified zeolites can be used for puridication of waste water of electroplating enterprises [3].

The article present results of investignation of chemical properties of natural and modified, Far Eastern zeolits (Chuguevsiy - A, Lutogskoy - B, Checkovskiy - C deposits0. The content of zeolite phase was determinetde by NH4+- ion-exchange and semiquantitavly by nuclear magnetic resonance. -H1

It was showed that the value of ion-exchange capacity on sun of cations tuff of Chekhovskiy deposit (C)(Sakhalin) has highest.

In comporison NMR - H1 data for the tuff A, b and model zeolite show that coutent of zeolite phase in the tuff B is more, than in tuff A, so as known [4] that ion-exchange, decationation, and modification of zeolite by metals and metal complexes, of investignation pocesses of drinking water purification and chromotografy of peptides. Subsequently by treatment of acid and alkaline it were prepared the sorbents with highest ion-exchange capacity in relation to ions of heavi metals.

The obtained data of ion-exchange for NH4+ - ion show that there are great diferences in the feature of cations assigning nature of zeolite. The analysis of NH4+-ion sorption isotherns show that order of exchange is same: Mg+2<K+<Na+<Ca+2 for all zeolites (A,B,C). This counected, to our opinion, with changing of site's accessibility, consequentky, decreased diffusion hindrance of exchange.

On the basis of obtained data it was concluded about thepractical application of Far Eastern zeolites. It were studiend featureof zeolites A and B at trearmen by acid depending upon concntration of acid, time of treatment and size of particles in static modes. The obtained date permit to calculate most optimum time of treatment, concentration of asid for every size of particles and to find the optimum conditions for tuff A and B. It was studied the interaction of tuff B witn solutions of NaCl and NaOH in static modes. The sodium ion-exchange in the dependence upon size of particles for starting zeolite (B) shows that same order of exchange: Mg+2<K+<Ca+2. However, of decreasing of size of particles the value of Mg-ion-exchange is been equal value Ca-ion-exchange. Probably, Mg-ion are placed nearly to surface of zeolite and with the increasing of surface increased the degree of ioh exchange.

At the unteration with alkaline it was showed that the lattice of acid treatmenting zeolite (B) is destroged more than natural zeolite (B). We have worked the several methods of modification of natural zeolites.

On the basis of these methods we obtained the antibacterial sorbents and sorbents having the metal complexes on the surface of sorbent. Antibacterial sorbents were prepared by interection of modified zeolites with silver contaning solutions. The properties of modified zeolites were studied in processes of drinking water purification. It were prepared the effective sorbents for separating and selectiving of alkaline phosphotase by treatment of natural zeolites by metalferrocianide complexes in comporison with the zeolites modifiing by metal-B-diketonates complexes. By potentiometric titration the all initial and modified forms of zeolit have been studied.

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IN RURAL AND URBAN AREAS OF BELARUS

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Nowadays the issue of an adequate drinking water supply attracts attention of population as well as governments in all civilised countries. The necessity to solve this problem is explained by a general deterioration of water sources and therefore by difficulties in providing the quality of drinking water that would meet the sanitary and hygiene requirements.

It is well-know that one of the most useful means of water management is setting efficient norms. The volumes of scientifically grounded norms define the general level of the water consumption culture, and allow to plan and control the use of water resources, as well as the allocation of industries on the territory of the country with a proper regard to the water factor.

Recently the importance of water consumption norms, and especially water discharge norms with regard to water quality has increased due to necessity to deal with a number of nature conservation issues, and in particular, by the necessity of assessment of anthropogenic loads on rivers, natural and artificial lakes, and ground waters. In cases, when water consumption and discharge control is not properly organised due to certain reasons, "aggregated" norms can be the only and quite efficient means of forecasting and regulating above-mentioned resources.

In 1992-1995 Central Scientific Research Institute of Multipurpose Use of Water Resources developed aggregated current and perspective (to 2010) norms of water consumption for drinking and communal needs in rural and urban areas. Taking into account numerous factors, the most important of which is the level of water supply to households, water consumption and discharge standards

apply in 200 cities and towns and all administrative rural regions of Belarus.

Depending on the category of a town, the value of the water consumption norm per capita is between 200 and 300 litters per day. For rural areas the aggregated norms are differentiated for drinking needs and general water consumption, including water used in private small holdings, farms, and small agricultural processing industrial enterprises. The values of the two above-mentioned norms are 95-115 litters per day, and 260-380 litters per day per on rural resident.

There are certain peculiarities in setting the norms of water discharge in agriculture. It should be mentioned that in rural areas in Belarus water discharge systems are organised on the agricultural processing enterprises, while water discharge systems from the residential areas and even from comparatively big cattle-breeding farms are not constructed. At the same time, the waste from these areas cause a serious danger of soil, rivers, and lakes pollution due to a high concentration and big amounts of pollutants in it.

Taking into account all the above-mentioned factors, we need to change the existing attitude toward water discharge practices in agriculture by introducing a notion of "total discharge of the area", which would include both controlled discharge of waste water from the point sources, and all uncontrolled discharge from scattered small and medium water consumers, as well as diffusion pollution sources, such as agricultural lands, rural residential areas, irrigation facilities, fuel and fertilisers depots, wastelands. The list of diffusion pollution sources can also include: water erosion of soils, fertilisers wash-off from the fields, surface and ground waste from industrial areas and military objects. The observation and calculation of total water discharge in rural areas can be conducted by using imitation computer models of certain river basins parts. An imitation computer model, using Geographical information systems technologies provides the possibility of a quantitative and qualitative assessment of total water discharge as well as the assessment of pollutants balance, depending on proportional loads of all point and diffusion sources per unit of area with regard to anthropogenic loads in the region, efficiency of agricultural objects, structure and types of flora, efficiency of land use, length and intensity of precipitation, slope of terrain, hydrogeological and hydro-morphological peculiarities of rivers catchment areas.

As an example an imitation computer model is developed and was tested for the catchment area of Uzdyanka river, included in the Neman basin.

DESIGN AND CONSTRUCTION OF THE WORLD'S LARGEST DAF WATER TREATMENT PLANT - FRANKLEY, UK

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The proposed paper will look at the various aspects of the Birmingham (UK) Water Treatment Plant Redevelopment Strategy with secific emphasis on the many factors that lead to the selection of the dissolved air flotation (DAF) as a main stage of clarificationand the subsequent construnction of the largest DAF plant in the world.

Severn Trent Water recognized the need to upgrade the existing treatment facilities at Frankley which is the lsrgest treatment plant in Severn Trent (Average 320,000 m^3/d to 1.15 million customers). A redevelopment plan was established in 1986 with the objective of providing new treatment facilities for Birmingham that would ensure complians with the EC Drinking Water Directive.

A pilot plant was built to give maximum flexibility of operation such that various combinations of equipment and chemicals could be tested concurrently. A 20 m^3/h (subsequently increased to 30 m^3/h) DAF plant was installed alongside a 70 m^3/h sludge blanket clarifier and a bank of primery and secondary filters. Extensive on line instrumentation and computer based data logging system was also provided to monitor the various treatment streams. The total cost of the study over two years was US $ 900,000 (L 600,000) and was one of the most extensive pilot studies ever commissioned by Severn Trent.

The large scale pilot study therefor provided the confidence to establish the process stream that would achiev the requiered treated water quality targets. This was based on the provision of an additional stage of treatment involving DAF and remodelling an existing bank of forty rapid gravity filters.

The proposals for the redeveloped works provided for a maximum treatment capacity of 450,000 m^3/d with two streams of 10 DAF cells. Each cell having a maximum capacity of 26,400 m^3/d.

The paper will describe some of the commissioning procedures and performance test on the DAF plant and assosiated equipment. It will also focus on one of the largest applications of carbon dioxide for coagulation pH control and its combination with lime to enhance alkalinity and reduce the corrosive nature of treated water. Attention will be drown to the problems of transporting, treatment and dewatering of DAF sludges to 5 %

DS, on one of the largest, membrane, sludge press installations in water treatment.

The estimated outturn capital costs for the Frankley scheme US $ 105m (L 70m) and the commissioning of the new plant has generated an increase in operational cost of at least 300 %. These cost will be analysed and a report given of the work undertaken to optimize the DAF plant.

AKMAG KITCHEN UTENSILS SET FOR MAGNETIC PROCESSION OF DRINKING

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Magnetic treatment of drinking water removes excess smell of chlorine and controls pH of water. Lately there were developed new technologies and deirels for magnetic treatment of running water in order to improve its biological and terapentical properteis. We invented the new devices for magnetic liquid procession in it's boiling "Aqmag-geyser" and for magnetic processing in the mixing process "Aqmag-mixer". The constructions of these devices are guaranteed by patents of Russian Federation and are patented abroad. The devices can be used in everyday or special domestic technics such as cylindrical capacities of different sizes. For the first time in one device many basic factors are realized simultaneously, that assures the achievement the maximally possible useful affect from magnetic processing: multiple processing, limited tensions of a magnetic field and graduant of its changing in the processing area, the speed of flowing liquid, and the time of it's staying in the processing area, oversaturated state of processing medium at the starting stage of its processing, the possibility of using it straight away after finishing the process. Dishes and plates "Aqmag" are made from materials that can be used in food industry.. "Aqmag - the geiser" is designed for magnetic processing of drinking water in it's boiling process in the vessels with ground heating-tea-pots, coffee-pots, saucepans. Aqmag-G consists of cylindrical hull and submerged removable magnetic device. The magnetic device is placed at the hull bottom, in which the certain quantity of fluid is poured, submitted to magnetic processing. The hull is placed on the heating surface of an electric-range or gas burnes. Under the water boiling at the expence of steam, the pressure in the circular pipe over the magnet for 25-40 mm water-post is less than at the same level outside the pipe, so the fluid from the bottom part of the hull comes into the magnetic device, than the continuous circulation of fluid affect it in the clearance between the disk-funnel and the hull's bottom in the magnetic field, created between them. Then continuous the magnetic processing. While the water boils, maintained the circulation of water and at the same time it's processed in the magnetic field. The boiling time is for 5-10 minutes.

"The Aqmag-mixer" is intended for process liquid under the stable temperature and consists of cilindrical hull similar outside to coffee-pot, submerged magnetic device, removed by hand in the hull, like piston. The quantity of fluid (water) submitted to magnetic processing, pours into the hull. With the help of a special handle the submerged device removed up-down the necessary times, during this movement the liquid percolates in the clearance between disks in the magnetic field, created between them, and than the magnetic processing. In the movement down, the effort is made on the handle 10-15 kilogramms. It provides the pressure overfall at the entrance and exit from area of magnetic processing 0,1-0,15 ilo/square centimeters and accordingly, the flow speed of liquid between polar's points 1-2 meters per second. The magnet of cilindrical form is situated in the secure hull, the tension at its ends 100-200 and it secures the tension of magnetic field in the working hole 30-50. The length of a orking hole is 30 millimetres, the distance between polar's disks points is about 1 millimetre.

The kitchen's utensils is produced according to patents of Russian Federation NN 760646, 2022935, 2022936, 2036163, 2049734. International claims for inventions PCT/RU 94/00250, PCT/RU 94/00251 .

The security of using drinking water under processing of magnetic field in utensils "Aqmag" is confirmed. The results of sanitary expertise of materials and hygienes tests, that had been conducted in Moscow scientifical-research institute under the name of Herisman, confirmed the absence of negational influence of magnetic processing with using devices "Aqmag" on Sanitary-chemicals reading of water quality. The researches for studing biological properties of water, processed devices "Aqmag" by ways of fractional starvation come to the conclusion, that magnetic water by toxical affect and fixing negating biological operation hasn't.

Medical tests starting from the autumn 1993, were carried out in the resort of Penza town; and beginning from December 1995-at the Institute of Proctology (Moscow). Detected are positive curing results. Series production was started at the Moscow Experimental Metallic Plant.

SUITABILITY OF SURFACE AND WATERS OF VOJVODINA FOR IRRIGATION

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The northern, plain, part of Yugoslavia is characterized by a high level of applied amelioration measures and intensive agricultural production. The established network of drainage canals of total length of about 18 000 km covers an area of about 21 000 000 ha. Recently, climatic changes and the needs for intensified agricultural production have been closely related to the practice of irrigation. Together with the canal network of the Hydrosystem Danube-Tisa-Danube, the rivers the Danube, the Tisa and the Sava ensure sufficient amounts of water for irrigation of about 5000000 ha of soil. Irrigation assumes the use of water of appropriate physical, chemical and biological characteristics. Sometimes, when water of suitable quality is lacking, use is made of waters whose quality fulfills no the established criteria. The use of more mineralized water of irrigation has already caused in some Vojvodina regions the appearance of secondary salination of the soil within some irrigation systems.

Water applicability for irrigation can be estimated on the basis of ecological, agronomic, technical and economical criteria. The work shall deal with the analysis of the possibility of applying some agronomic classifications of water suitability for irrigation (U.S. Salinity Laboratory, Nejgebauer's classification, Miljkovic's classification, FAO classification).

The parameters of water quality of rivers and the canal network of the Hydrosystem Danube-Tisa-Danube are systematically monitored. The above classifications have been applied on the location that are potential source of surface and ground waters for irrigation.

The results of previous investigations, carried out on the Vojvodinian location where there is a real possibility for irrigation, indicate the applicability of the mentioned water classifications. Acceptable estimates are obtained using older

IWSA-APPROACHING 50 YEARS OLD

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In June 1997 the International Water Supply Association celebrates its 50th Anniversary and call still claim to be the world's only international professional organisation concerned with water supply. Its interest and influence is global with a world-wide membership of countries representing all political and economic systems, ethnic origins, religious beliefs and nationalities. Through its membership more than 100 countries are represented which accounts for 95 % of the worlds water supply.

During its life span, IWSA has not altered its basic aim- the free exchange of information and ideas between all those involved in water supply. Inevitable, however, it has adapted to the ever changing needs of the water industry environment and needs of its members. There is now a much wider participation from developing and newly industrialised countries and IWSA regional associations have grown in Africa, South and Central Asia, and the Asia Pacific area.

In parallel with the growth in all types of membership has been the number and diversity of special conferences, workshops and seminars. These are in addition to the main biennial world congresses and provide a continual source of knowledge and information for the members and the proceedings of such conferences and workshops are published in a range of IWSA technical journals.

From the less developed regions to those industrialised countries of Europe and America there is a growing importance to IWSA of the management, financing and economics of providing water supply. These are in addition to the more traditional scientific, technical and engineering aspects of the water supply industry.

In recent years and particularly with the greater active participation of developing and newly industrialised countries, has come the emphasis of links between resources, water supply, sanitation, solid waste disposal and agriculture. This has encouraged closer co-operation between IWSA and the professional and academic bodies working in these related fields.

Such co-operation must increase in the future as demands for new water resources are seriously constrained by pollution and competing demands. The overall protection of the environment must take a higher profile in the deliberations of IWSA members and specialist committees if the water supply issues of the future are to be comprehensively addressed. This is more relevant as increasingly stringent water quality standards are to be achieved by water suppliers.

Politicians and water managers need to work more closely together with a better understanding of their respective problems. I t is pointless to make political decisions concerning water supply which

can not be fulfilled through lack of available funding. Equally, short term political decisions are no answer to the longer term problems. It is essential that the full cost of providing the service and future works are fully funded through the charging mechanisms. IWSA addresses these types of concerns and provides a forum for enlightened debate.

This emphasis and the concerns for the water environment can only increase as megacities are created through rapid urbanisation and population growth. Where 40% of the world's population depend on water resources that are shared by more than one country all problems are compounded.

In order to respond to the local, regional and international needs of water supply the Association is organised and controlled through its General Assembly, Executive Board and the Scientific and Technical Council. Representatives of Corporate Member countries oversee the affairs and nominate members to the various technical committees. Committees are organised within four divisions, namely Management, Distribution, Water Quality and Treatment and Resources.

Within each committee Task Forces have been established from those members of the Association wishing to be involved and who have the appropriate expertise. Non-members of IWSA can become members of a task force and subsequently apply for membership of the Association.

Of growing importance are the regional activities of the Association whereby local, national or regional issues can be addressed cost effectively. The Association also maintains close collaboration with non-governmental organisations such as the World Health Organisation, international banks, funding agencies and is represented on the Board of the World Water Council.

The IWSA provides a unique forum where international concerns, problems, experiences can be discussed, and results published and circulated with very practical benefit to all those who are responsible for providing water supply.

IWSA truly Unites the World of Water in tackling the issues now and in the future.

DISINFECTION AND TOTAL QUALITY MANAGEMENT

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Disinfection is the primary purpose of water treatment and therefore the most important. Seven Trent Water operate over 200 water treatment works in the United Kingdom, involving a variety of disinfection processes and produce over 2000 Ml/day of high quality potable water. Despite the undoubted technical effectiveness if the disinfection processes the company have applied total quality management principles to identify improvements.

The paper will describe how total quality management has been used to improve the design and installation of disinfection system, the training of operators and maintainers, the application of preventative maintenance to produce breakdowns and procedures used to measure and set chlorine residual targets. It will also discuss the method used to assess the extent of the errors within typical disinfectant dosing system and the accuracy and precision of chlorine residual instruments.

The results of the eighteen month total quality management project on disinfection are currently being implemented throughout the Company.

PRACTICE OF DRINKING WATER CERTIFICATION

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VNIIstandart set up the certification body for drinking water and purification facilities, accreditated by Gosstandart of Russia in 1995.

Documents on "The System of drinking water certification" developed by scientists and specialists of VNIIstandart jointly with the representatives of the Scientific organizations of the State Sanitary and Epidemiological Supervision, the Ministry of Health, the Russian Academy of Medical Sciences and the Ministry of Construction, were used as a scientific and methodological basis for its practical activities (1). The initially used principle of voluntary certification of the System objects revealed a considerable interest of manufacturers and supliers in independent evaluation of products. It was primarielt applied to bottled drinking water purified or prepurified ad domestic purification facilities used in water-purification facilities for materials and specific types or equipment, pipes and fittings.

From 1996 the certification body launched a mandatory certification of bottled water and water-purification facilities (individual, combined, domestic and local ones) interacting with leading testing centres and laboratories within the State Sanitary and Epidemiological Supervision, the Ministry of Health and the Ministry of Nature and leading research institutes of industries.

Tests for certification purposes are mainly carried out by the Principal Testing Centre for Drinking Water, testing laboratories of the Institute for Medical and Biological Problems and the Central Research Institute for Epidemiology. 26 highly skilled experts including 5 doctors and 13 candidates of sciences participate in the activities of this certification body.

The certification body has issued 100 conformity certificates with more than half of them for purification facilities. These latter, as known, are broken down into filtering, absorptive, membrane and combined ones. The first ones are typically represented by fine water-purification facilities (FWPF) produced by Interbranch Joint Stock Company "Sodrujestvo" in Krasnodar with filtering parts made from coked pure titanium powder. The second type is represented by the purification facility called "Vodolei" produced by the joint stock company of closed type "Eco" in Moscow, the basis of which is silver-plated activated coal. The best ones from membrane facilities are "Rucheek" produced by the joint stock company "Polimer-synthesis" and "Neptun" produced by the joint stock company "Membranotekhnika" in Vladimir. The facility "Rosa" produced by the joint stock company of open type "Utes" in Uljanovsk is among the combined ones with water filtering through the system "coal plus membrane". A similar facility of Israelian make "Tami-4" supplements it with ultraviolet decontamination of water. Less reputed are the following domestic filters: "Rubej" - due to their inconvenience in usage (bulky drip discharge), "Vita" (Voronezh) - due to their low volume of water purification, "Vitaqua" (Germany) - due to a lack of decontamination properties inrespect of micro-organisms.

Certification of the majority of objects follows the schemes including the examination of their production. For example, the examination of production for bottling drinking water of "Moskovija" type (Zelenograd) showed that production conitions ensured the stability of product quality.

The principal Testing and Scientific Centre for Drinking Water (the PTSC DW) set up within VNIIstandart resolves such tasks as scientific and practical inspection of the drinking water quality control and testing system, development and im-lementation of new highly productive procedures for the instrumental analysis of drinking water com-position. The Centre has laboratories for element analysis, chromotography, polyarography and analysis of waste water.

The Centre was initially oriented to perform water analysis for a wide range of indicators laid doun as a basis for draft sanitary norms and rules and performs currently testing of more than 80 indicators. Analysis are performed with the usage of standard documents (GOSTs, ISO Iss and re-ommendations of the Ministry of Nature) as well as documents developed by PTSC DW or metrologically certified.

The PTSC DW applies such highly sensitive methods of analysis as atomic absorption spectrophotometry to determine inorganic com-pounds, gas-liquid chromatography to determine organic compounds (pesticides, toxic volatile galo-genorganic compounds formed in the coarse of water chlorination), liquid chromatography to determine anion and cation composition of water, polyaromatic hydrocarbons and other methods of chemical analysis (spectrophotometric, titrometric ones).

To perform testing the PTSC DW is equipped with up-to-date analytic instruments of domestic and foreign make included in the State Register of measuring equipment or metrologically certified.

The testing quality ensurance system within the Centre is operating on the basis of ISO IS 9003, which made it possible to develop an international control procedure for quality ensurance and promptly control quality indicators of results of quantitative chemical analysis, accuracy and reproducibility of measuring results. The PTSC DW is a prototype of the typified laboratory for water quality analysis as specified by new internal normative documents (sanitary norms and rules and GOSTs).

The Centre is in permanent cooperation with the Central body of drinking water certification system and the State Sanitary and Epidemiological Supervision organisations, has arrangements with such widely known distributors of water-purification equipment as the Scientific and Industrial Association "Alternativa", "Trading house Komin-teks", the joint stock company "Mira" and with such producers of analytic equipment as the Scientific and Industrial company "Ljumeks" and the joint stock company "Sartogosm" (Saint Petersburg), the joint stock company "Kortek" and the plant "Chromatograph" (Moscow). It is now arranging relations with such foreign suppliers of analytic instruments making as "Perkin Elmer", "Eppendorf', "Anglia Instruments", "Merck", etc.

In responde to the recent urgency of application of the state reference materials in testing the Centre has developed, certified and included 12 new types in the State Register of measuring equipment.

The Centre performs periodical researches of "Mosvodokanal" tap water quality with sampling directly from consumers living within 4 water supply facilities intended for Moscow. Results of this control were laid down as a basis of the methodology for drinking water certification of centralized water supply systems.

The PTSC DW is actively improving the metho-dical developments made in the quantative chemical analysis. It has developed and metrologically certified the procedures for gaschromatographic determination of chlorine-containing compounds, liquid choromatographic determination of anions, etc., dealing with preparation of 6 draft state standards for analysis procedures of water samples with toxic components including mercury, cadmium,

chromium, chlororganic pesticides and volatile galogenorganic compounds.

Thus, the timely creation of the certification body and the PTSC DW by VNIIstandart made it possible to practically master the scientific approaches to certification of the System objects, establish the advanced research centre for certification in the area of water supply and contribute to the solution of one of the most urgent current problems - the supply of consumers with high-quality drinking water by standartization, metrology and certification methods and means.

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CERTIFICATION OF QUALITY SYSTEMS AND PRODUCTIONS IN CENTRALIZED DOMESTIC WATER SUPPLY SYSTEMS

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Taking into account the foring experience the scientists of VNIIstandart of Gosstandart of Russia jointly with specialists in the area of water supply and health protection have determined a scientific basis for certification of drinking water in the centralized domestic water supply systems (1). The experience gained in the solution of quality problems and certification of sophisticated orgazational and process systems in a number of industries has also been taken into consideration.

As specified by the System the certification of drinking water in the centralized domestic water supply systems is performed with the usage of the following methods and approaches: on the basis of the water supplier's application-declaration; on the basis of certification of productions and (or) certification of the water supplier's quality systems. This approach is specified by the need to provide varions options in methods and extent of certification for water suppliers proceeding from their own industrial and technical capabilites, degree of quality system perfection and managability of drinking water production processes.

The principle of evaluation of stable conditions providing for quality of drinking water supplied by water manufacturers to the people and its conformity to hygienic requirements and standards was laid down in the basis of the given methodology. The latter takes into consideration such factors as the stability of water quality in the water supply source with account of seasonal variations and potential availability of impurities in it, conformity to the process system for water preparation (purification and decontamination of water), needs of consumers in the volume and quality of water to be supplied, reliability of the control system for hazardous impurities in the water supply source and water supply network, feasibility to take prompt actions to make water hazard and harm-free.

The specialists of certification bodies certify productions and quality systems in the centralized domestic water supply systems on the basis of typified and working procedures intended for examination of specific production including technological process for water preparation, the system for drinking water supply to consumers, the system for logistics, maintenance and repair of equipment, the system for water quality control as well as evaluation of quality of drinking water supplied to consumers.

The examination of the technological process for water preparation specifies the evaluation of conformity of water decontamination and purification processes to requirements set to ensure requaired quality of drinking water supplied to the distribution network under real conditions of available impurities in the water supply source and also available reserves to make it possible to increase "the barrier" role of the water preparation system under seasonal variations of water quality in the water supply source and in the case of other unfavourable factors. Besides, the state of reservoirs fore pure drinking water and distribution systems is examined in parallel with other factors, which can significally affect the operating reliability of the water supply system and quality of drinking water supplied to consumers.

When examining the logistics, maintenance and repair, the evaluation is made how the system provides for the supply of required reagents, process equipment, mechanisms and implements, how they are kept and applied, how sediments are removed and filters replaced and how is arranged repair and restoration of networks, equipment and other objects ensuring operation of the centralized domestic water supply systems as a whole.

The examination of the water quality control system covers the evaluation of conformity of applied methods and technical means to valid normative documents specifying authenticity and accuracy of analyses results of quantative values of indicators under control. It also checks how the requirements specified by control methods (procedures) are followed, how production laboratories are equipped with appropriate equipment, how skilled is personnel and how timely the measuring equipment is verified, etc.

The objects of examination and evaluation under the certification of quality systems are: activities in production management, drinking water supply to consumers and its quality ensurance; the system for drinking water production; and drinking water quality.

Management activity is cheched and evaluated for conformity to requirements as specified in ISO IS series 9000 and their internal similar documents (GOST 40.9001-88...40.9003-88) according to the pettern reflecting the real state of the specific water supply system (conpeteness of know-how under implementation, reconstruction and updating activities, etc.).

The drinking water production systems are examined and evaluated according to general rules as aforesaid. Drinking water quality is evaluated on the basis of information materials on the results of water quality analyses performed under the plenned production and process control and during periodical examinations carried out by the state supervision and control bodies. The given methodology was practically tested when preparing "Mosvodokanal" conpany for certification (7).

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NATURAL ZEOLITES, THEIR PROPERTIES AND USE FOR PURIFYING WATER IN PISCICULTURE

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Natural zeolites (NZ) are aluminosilicates with crystalline structure. NZ possess unique ion-exchange, molecular screening and catalytic properties. NZ can purify water of such toxic substances as heavy metals, ammonium forms of nitrogen, mineral oil products, chemical poisons and, moreover, saturate water with oxygen.

The above-mentioned characteristics of NZ allowed one to use this mineral to create an ecologically pure habitat for hydrobionts in pond fish breeding and in hatcheries at fish farms in static and dynamic conditions.

In pisciculture the use of polluted water from natural waterbodies causes different fish diseases, including those of toxic character, and as a result the fish productivity of ponds lowers.

To create optimal hydrochemical conditions for the rearing of pond fish natural zeolites have been applied to purify water environment of ammonium, ammonia, heavy metals and saturated water with dissolved oxygen. Sorption properties of zeolites of different deposits in Siberia and the European part of Russia have been studied. The greatest effect of water purification has been obtained when shivyrtuin and pegasin were used.

Certain technological aspects in the process of rearing pond fish have been dealt with:

- norms, techniques and periodicity of applying zeolites have been worked out;
- the prolonged effect of NZ in ponds have been determined.

It has been observed that zeolites positively affect the formation and development of natural feeding resources in fish breeding ponds which makes it possible to reduce the consumption of artificial feeds by fishes. At the same time a significant restructuring of both specific and quantitative composition of the plankton community has been observed and this fact created

conditions for a favorable detrital path for the development of productive relations in the biocenoses of ponds. The physiological state of the hydrobionts has been improved in the ponds with NZ additions. A trend has been observed towards a decrease in the accumulation of toxicants in fish while the productivity has risen from 30 to 85 % and the survival rate has reached 45 %.

NZ were also applied in the hatchery of a fish farm under conditions of the dynamic use of water. For this purpose a special cleaning unit has been designed. The dependence of the sorption characteristics of various zeolites was studied on the dynamics of the water stream, on the amount of the sorbent and other factors.

The effectiveness of the purification of water supplied to the hatchery was checked according to the results of the hydrochemical and biological control. In this case the zeolite filter purified water of heavy metals, chemical poisons, detergents and mineral oil products reducing their content to the MAC and below. Biochemical tests of the eggs being hatched have indicated the improvement of its lipid status. The death of embryos was reduced twice in the purified water. The positive results obtained have shown that NZ can indeed be used in various purification systems.

The observation of the effect of NZ on the quality of water in hatchery ponds has led to the improvement in the rearing of fish. A technological regulation for the employment of natural zeolites has been worked out which makes it possible to grow fish of high quality, to increase fish productivity and successfully deal with certain ecological problems concerning the purification of sewage waters in fish farms. All this can be done without any sizable increase in money and labour expenditure.

RETURN USE OF SOFTEN WATER IN DYE-FINISHING DEPARTMENT

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In dye-finishing enterprises if textile and knitted fabric industry the softening of the processed water to the residual stiffness less than 2 g-eq m^{-3} allows to make essential approvement of the products quality. In the West Ukraine the problem of reconstruction of similarly enterprises is pointed when it is necessary to install new water-purifying equipment on the existing limited areas. That's why the 1st requirement to such kind of equipment is its small size and also a small power-and metal capacity.

The new construction of the small size, combined of hydraucyclone type unit (HTU) was designed on the department of hydraulics and sanitary technics and received the author's certificate (A.s. 11526652 USSR). The distinction peculiarity of this unit is the existence of the filter element, which is installed into the unit and allows to purify lighten water from impurities. The unit can be used in 2 nodes of the return system for manufactured water supply of the dye-finishing works during softening of added water by the lime-soda method the higher temperature and for regeneration of the developed dying solutions. The peculiarity of the water-supply system in Lviv, which is placed on the main European water division is the use of drinking water for domestic and industrial needs. That's why the pipe water was additional to the return water-supply system in dye-inishing department.

The HTU of the lime and lime-soda process of softening pipe-water is more specific in this unit. In the case of soda-softening water the reaction has the first order with the effective velocity constant $k_I' = 3{,}55 \cdot 10^{-3}$ sek^{-1}, and in the case of lime-soda softening - the second order with $k_{II}' = 7{,}50$ $dm^3 \cdot mol^{-1}$ sek^{-1}. Kinetic data make evidence on the diffusion detarding of the essential stage of complex softening water process.

It is proved that warming of soften water up to 40-50°C vitally intensify the process and make the scene of water-preparation easier. It is proved that there is a reason in using the Unit for extracting suspended substances from hot dye solutions with saving dyers, SAS and textile-auxiliary substances. Such kind of lighting dying solutions later enrich with necessary components and again return to the basins for dying. It gives the possibility to save expensive materials and exclude the dump of industrial processed water which is nor purified enough.

3 types of loading filter elements of the Unit were compared: crystal sand, fuel slag of Brushtyn hydra-electrical station and synthetic fibers, The last one turned out to be the optimal filter material, which stops suspended substances for 97%. With the aim of optimizing the scheme of water-preparation it was suggested to use the warm of finished hot dye solutions for warming make-up water, which has to be softened. This scheme was introduced on the Lviv Industrial Enterprise "Luch".

NEW TECHNOLOGY OF WATERSUPPLY IN NORTHEN WINTER TERMS

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On the basis of experimental researches we have discovered the field of high transmitted capacity of waterlines, which can work at low minus temperature. As for this phenomenon, we have created an automatic system, which is totally operated by heating regime of waterline. Comparing the current methods of delivering water new technology increases the piped capacity of waterlines on 15-20% and reduces the expenditures of energy on 10-15%.

New technology can be used in waterlines of water delivering system. The technology reaches the biggest effect by delivering water inside the above round laying pipelines in Northern terms when minus temperature is very low and winter lasts long.

The protection of waterlines from freezing and failing is maintained by special protection facility "iceproline" by name and special unfailed pipelines, which have been devised on our Academy.

The principle of delivering water delivering technology in defining and maintaining heat balance between the piped liquid and external cool factors (minus temperature and the speed and the direction of the wind). The water delivering and water heating can be carried out in one time. The necessity of water heating is defined by the calculation. The prepared program of heating calculation takes into consideration the heating of the phased water transmission. ASKY-TRV defines the heating regimes of water delivering inside the waterlines at which water is transmitted with minimal expenditures for heating.

The fixing of heating and hydraulic conditions is corrected by the personal computer with the group of sensors (which senses the temperature of water, air, pressure, thickness of the ice). The prepared program was introduced and showed good results at "Kolkhoz's Spring" waterlines near Tynda, BAM. The suggest program can make possible essential energy, fuel economy for Russian North and for Alaska, Canada and northern region of scandinavian countries as well.

New technology was protected several patents.

TECHNICAL STATE OF TBILISI WATER SUPPLY SYSTEM, QUALITY OF WATER IN DRINKING AND TECHNICAL WATER SUPPLY NET OF TBILISI CITY

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Capacity of head constructions of Tbilisi watersheds make 21 m^3/sec. The basis of the water supply system of Tbilisi city is presented by municipal watersheds. Part of these facilities belongs to partly open infiltration type (Aragvi River basin), the other part - open type constructions (Tbilisi water reservoir). 2 m^3/sec of above mentioned amount (21 m^3/sec) falls on deep sited water bearing horizons of Mukhrani valley.

80% of citizens receive water without any restriction, whereas for 20% - water provision is scheduled. 82% of supplied water amount is consumed by population of the city, the rest 9% - fall on municipal services and industrial facilities.

Tbilisi water supply system comprises 45 pumping stations and 41 reservoirs with total capacity 305000 m^3. Mentioned facilities ensure stable water supply and adjustment of water provision regime. Instability coefficient - 1.25 - 1.3 - is. Total length of water pipe makes 3200 km - are amortized. Total number of abonents - 40700. 15300 abonents are provided with water-meters. Working regime of pumping stations is regulated by local systems of signalization and distant control.

Perfection of water quality is one of the critical problems. Quality water provision is vital for care of public health and environmental protection.

The main goal of the works commenced by staff of the firm GAMMA in October 1995 consists in obtaining of thorough and reliable information about the quality of drinking water in municipal watersheds of Tbilisi city. Works are carried out within the limits of the program of organization of stationary hydrochemical monitoring supervision.

The main steps foreseen by the program are:

- selection of probes (quarterly) from characteristic points of watersheds; water pipe system and private abonents. Goal - determination of ecotoxicants of all groups of danger (70 parameters);
- statistical processing of obtained data ,and feeding of this information in existing data bank;
- drawing up information report.

Obtained results will be stated in report.

THE EXPEDIENCY OF USING ACTIVATED CARBON TL-830 IN WATER TREATMENT CONSTRUCTIONS OF THE WATERSHED IN ORENBURG

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Lately "Ecobios" and NII KVOV AKH (Scientific Research Institute of Water Supply and Treatment, Moscow) have been reconstructing water treatment system of the urban watershed using activated carbon absorption and ozonization. "Ecobios" together with "Chemviron Carbon" (Belgium) have prepared the program of improving drinking water quality in Orenburg by means of activated carbon absorption. In the given oxidizing-absorption method of water treatment in the Ural river the activated carbon removes low-molecular products of zone oxidation of organic substances. Our task was to choose the right quantity of carbon so that it could have filter and absorbent properties. Two kinds of activated carbon were offered: AG-3 (Russia) and TL-830 (Belgium). We tested both substances under real conditions using river water and compared their filter and absorbent properties.

According to the experimental results AG-3 and TL-830 have an equally high filter capacity (85-90 %), but their absorbent properties differ. At the first stage of the cleaning process the absorption efficiency of TL-830 was 76-80 % and of AG-3 was 50 -55 %. Having cleaned fifty water volumes, the treatment efficiency of AG-3 dropped to 14 %, so the absorbent resources of AG-3 were practically exhausted while the efficiency of TL-830 at this stage was 51 %.

Industrial tests of TL-830 as a fast based on our experimental results were held under real conditions of Orenburg watershed. The efficiency of a carbon fast filter was compared with the efficiency of a sand fast filter. The test results proved a high water treatment efficiency of the activated carbon TL-830. For example, for 24 hours (in winter) 1 kg of TL-830 absorbs 0.22 g of loaded substances, 0.5g of solute organic substances and the 1 kg of sand filters 0.05 g of loaded substances and 0.1g of solute organic matters. Having analyzed the test results, we make a conclusion that it's advisable to use the activated carbon TL-830 instead of sand filters in Orenburg watershed. Beside the application of carbon TL-830 does not demand new building and equipment.

ECOLOGICAL EDUCATION AND SOLUTION OF THE PRACTICAL PROBLEMS OF THE WATER-USING

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Practice of the water-using stimulates strongly to increase the level of not only the professional education of the specialists in this field but also their fundamental knowledge.

The State Enterprise "Vodokanal St.Petersburg" does its best for professional personnel training: the Lycee of the proper orientation was founded; the education of specialists of various ranges is in progress, the help for high schools was organised. Despite that fact that a word "ecology" became popular and everyone as deals with the ecology, the ecological ignorance rule over all the social sphere.

Meanwhile, the deficiency of the ecological education and training is fraught with the serious blunders in all spheres of the economic activity and results in realisation of ecologically dangerous and, moreover, economically wasteful projects. There is a plenty of examples. The economic development breaking the contact with the ecology transforms the Earth to a desert although the ecology without the economy also leads to the poverty and the injustice.

Overcoming the ecological crisis and building the economically stable society undoubtedly needs the multilateral approach and the hard work in special areas of the science and of the technique. However, the theoretical foundation for the development of the economic activity not against but in accordance with the laws of the Nature, is the object of the integrated science called "Ecology" which makes bridges between the natural, technical and social branches of science.

The ecologically based projects only can give both the economical gain and the ecological safety at the same time.

The necessary, universal and obligatory ecological education and training are legalized by "The law on the protection of the natural environment" of 12.19.1991 (Section IX, ar. 73, 74 and 75)- The general course of the state strategy of the nature-

protection activity, it is as declared in the Law, is the promotion of the scientifically based reasonable combination of the ecological and economical interests of the Nature and of the Society what is possible only after overcoming the ecological ignorance. Necessity of the popular ecological training is realised in the highest state power sphere. This fact is reflected in a series of documents; these are the Resolution of the Government of the Russian Federation No 940 of 08.12.1994, the State Educational Standard of the High Schools of 1995, the requirements of the Goskomvyz to the obligatory minimum of the contents and the level of the training of the Bachelors and the Masters of Science of 1994, etc.

The significance of the ecological education for engineers is stressed by that fact- that the announced by the Goskomvyz of the Russian Federation (as the state social order) competition for creating the manuals of the new generation includes in a list the manual "The Ecology" designed for students of technical areas; great attention is attracted to this manual. For the first time, the ecology is introduced into the obligatory minimum of the technical high school program of the fundamental subjects together with the mathematics, the physics and chemistry.

The aim of the obligatory ecological education in the high technical schools of Russia is caused by the new paradigm of the education: the engineers should obtain the basic education promoting the further personal development; to form the ecological outlook, the notion about the Man as a part of the Nature, about impossibility of living without biosphere protection.

Unfortunately, in localities, even in many institutions of St.Petersburg, despite of the actual State Standard of the object (EN-05), the ecology training is often substituted by delivering lectures on the environment protection and on the rational nature-using which are the routine readings in a cycle of general pr ofessional objects. This also contradicts the aims of the fundamental ecological education and the article 74 of "The law on the natural environment protection" which declares that the obtaining of a minimal ecological knowledge is promoted by the obligatory teaching the fundamentals of the ecology in all secondary and high schools independently of their profile. In accordance with the speciality, it is stipulated to give lectures on the environment protection and on the rational nature-using.

LIKE BAICAL DEEP-WATER PRODUCTION BUSINESS-TARGET

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At present the quantitative and especially qualitative shortage of drinking water in the world causes the search and working out of new courses. The project of using Greenland ice-bergs or desalinisation of ocean water for these purposes are very expensive. And just that's why the role of Lake Baikal, being the largest vessel of pure water, where 20 percent of the world fresh water reserve or 80 percent of the fresh water reserve of Russia is concentrated, increases. The water taken from this lake at a depth or 300 metres in accordance with its organoleptical, microbiological and hydrochemical parameters corresponds to the international high-quality drinking water standard is up to the International Organisation of Health service requirements.

Besides, the Buryat Republic disposes of the unique mineral springs, the waters of which are effectively used for medical purposes.

On the grounds of above-stated Russia, including the Buryat Republic, possessing the greatest economic value such as the reserves of mineral and fresh water has, and first of all the water lake Baikal, and having carried out its bottling and selling, can turn into the most prominent fresh and mineral water provider in the world.

Potential fresh-water market capacity in the world is at least about 20 billion litres; and in Russia and CIS is about 1 billion litres.

The Buryat Republic Development Fund has worked out the Baikal deep-water Production Business - Target. On the basic of marketing researches the market potential and its segment, as well as basic consumers were determined, and the marketing strategy was also worked out. The results from the production plan is the worked out concrete industrial process which determines the choice of the highly effective complex bottling production line.

And bellow we can list some lake Baikal deep-water Production projections of the financial plan. These projections are the most probable estimations of the future financial results of our enterprise concerning just the expected volume of production and silling, cost price, term of recoupment and profits.

The expenditure sum total is 64773222 thousand roubles. The annual volume of output is 2, 5 million of one-and-a-half litre bottles.

The cost price of one bottle is 2700 roubles. The planned sale price /including supertax/ excess profits tax - 4212 roubles.

According to calculations the production and sale of lake Baikal fresh water is a highly remunerative way of capital investments. The investment term of recoupment is 3 years after putting the enterprise into operation.

The calculations are made according to the price of the present situation on the first of August 1995 /1$ - 4600 roubles/.

When defining the estimate value it is accepted that all the equipment for the enterprise is imported. And the Russian side fulfils all the construction works.

CONTRIBUTION OF TOMSK SCIENTISTS TO SOLVING THE PROBLEM OF WATER PURIFICATION AND SEWAGE TREATMENT

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The greater part of works conducted in Tomsk on solving the named problem is concentrated in the inter-universities research program of State Committee of Higher Education of Russian Federation "Water Purification and Sewage Treatment". The innovational nature of this program implies including the projects mostly prepared for adoption in industry. From this point of view the investigations of the Tomsk scientists are considered acceptable because the problem of water supply in Tomsk and region attracted heightened attention already in early 70-es when the Kuzbass enterprises made emergency discharges in the upper flows of the river Tom. The underground sources of water also needed preliminary purification. All that accounted for the fact that the Tomsk scientists turned their attention to the problem about 30 years ago. The goal of the program on developing and adopting the techniques and installations for small-scale self-contained consumers very well suits the conditions of Siberia and Far East where there are of non-traditional purification methods also meets the possibilities and achievements of various Tomsk scientific institutions.

The success of the program is largely provided by the connecting link between the program participants and scientific products consumers. The Headquarters - High Voltages Scientific Research Institute and the Dead Scientific Council of the program fulfill the functions of the connecting link. The joint work stated with publishing a book, participating in regional exhibitions, organizing town seminars with the representatives of the ecological services from Tomsk and regional enterprises.

At the present moment the Tomsk participants of the program work in tow main directions. The first is the construction of a multipurpose technological line (modular units modification) for purification of contaminated water. The second direction is the comparison of engineering and efficiency factors of various purification methods; creation of a data bank of water purification technologies.

The basis for both directions' development is the regional approach that takes into consideration the natural peculiarities of underground and surface waters of Western Siberia and the interests of the region.

The components of the complex technological line are the devices and apparata created during the first stage of the program: reaction vessels for ozonizing the water, aerators, units for electrochemical and magnetic water treatment, hydrocyclones, sorption and metal-and ceramics filters, pulsed power sources. The mission of the second stage of the program is to achieve "flexible" matching of the units providing optimization of the technological process depending on the initial quality of water, the target utilization of the purified water, simultaneous up-dating and adjusting of separate devices.

The purpose of the information bank of the water-purification technologies is to assist the consumer to make well-founded choice of refining equipment. The peculiar feature about the data bank which is being developed is that it is primarily oriented towards the technologies adapted specially for local environmental conditions.

The selection concept of primary indicators has been developed, the initial structure of the data bank has been created, several layers of systematization and the most significant indicators reflecting the efficiency of this or that method have been picked out. The materials obtained by keeping up with the functioning refinement constructions, their advantages and limitations, consumers' reports have been regarded as the sources of information for the data bank.

RISE OF ECOLOGY SAFETY AND TECHNICAL RELIABILITY OF PIPE-LINE SYSTEMS

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Pipe-line are the systems of the life-support of the all living on the Earth, Their development and conditions exert influence on the people health and economical progress of society.

A lot of water-supplier pipe-lines and water-derivation pipe-lines over the territory of CIP are characterized by very metal consuming, they have very bad protection against corrosion and pollution of inside surface that is a reason of great litquids lossed, lowering capacity, ecology pollution of lithosphere, poisoning and expansion of infections disease. We were witnesses of accidents happened within 2 years after the 1-st Water Forum, that had disastrous effects for population and nature (flood of oil in republics Komi, Bashkortostan, accidents in Kharkov etc).

To raise the reliability and longevity of pipe-lines we have to use building and renewal of pipe-line systems plastic and metallic pipes with reliable cover of inside and outside surface of pipes.

It is necessary for Ministry for Building of Russia togerther with Minzdravmedrom of Russia, Goskomsanepidnadzor of Russia, Minprirody of Russia and MCHS of Russia to work up complex of organizational-technnical and norm-legal rules towards to preventation and liquidation of accidents and catastrophes occured by the reason of the depressurization of pipt-line systems.

AN OZONE GENERATOR AS A COMPUTERIZED INTEGRATID PNEUMOELECTROCHEMICAL SELF-CONTAINED ASSEMBLY

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1. The author having scientific, experimental and production activity experience in the field of powerful technological gas CO_2-laser and laser complexes see the paralelism in physical phenomena, construction and technological and physical metallurgy decisions, specialist profile and production conditions of laser and ozone-generator building. For all this they take into consideration community of principles of microprocessor controling, obstacle protection supply and laser and ozone-generator accident-free. All this has given and a giving hope of quick and optimal, for economy consideration, reequipment of laser mastering building and its adaptation to ozone-generator building. The author's experience withesses that the selected way is quite productive.

2. The world experience in this field, which can be estimated by the high scientific-technical level for separate aspects, but not as a whole (ozone-generators of the first generation), should be considered as a safe base for further researches. Computarization and integration, widely introduced and transformed the appearence of modern science and technology are much less reflected on ozone production. The meeting of this lack sufficiently increases the effeciency of ozonesythesis and ozonetreatment as a single technological process (the ozone-generators of the second generation).

3. The aim of modern science and practice in the ozonation field may be formulated as the necessity of theoretical and experimental researches: the complex of design and technological measures for perfection of ozone-generating installations, envisaging the application of microprocessing automate control system (MPACS) and, by this creating principles and prerequisites of the ozone-generator development of the new (second) generation.

4. It is necessary to solve problems meted for its achievements:

– the definition of perfection criteria and the optimization of ozone-generation installations in the general production system, the ozone application and ozone distruction (as in the example of purification system and drinking water disinfection for municipal economy);

– the development of physico-chimical conception for ozone electrosynthesis and electro supply sources;

– the creation of the type row of high voltage big frequency ozone-generators on the barrier discharge, the type row of the inverter sources of electrosupply for them; and the type row of the air preparation systems;

– practical integration of the monitoring and control means for air preparation systems, the ozone electrosynthesis, the water ozone treatment and the rest ozone distruction and the creation of information-situation model of ozonation technology; and

– the realization of the control of electrical parameters of the inverter electro supply source to physico-chemical parameters of the initial air, initial water and the waste ozone-air mixture (the using of

microprocessors, the development of the measuring apparatus and sotfware).

5. The creation of the theoretical preqnisites of microprocessor ozone-generator production and their practical realization.

AIR BREATHERS MANUFACTURING BY MEANS OF POWDER METALLURGY

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The current development of powder metallurgy techniques has provided vast variety of porous permeable materials, which may be used as a base for breathers and gas dispergators.

The domestic industry manufactures two basic types of porous permeable materials (PPMs) made of alloyed stell powders ПХ18Н9 under standart ГОСТ 13084-63:porous strips Х18Н15 - ПМ(ФНС) with thickness 0.1-0.25 mm, and sheets of Х18Н15 - ПМ (ПНС) type with thickness 0.5-5.0 mm. The length of both strips and sheets cannot exceed 900-950mm, while the width can be as high as 60-120 mm for ФНС and 220-350 mm for ПНС. The data for air pressure P, under which appearance of initial bubbles occurs in the standart experiment on pore size definition, are as follows:

Table.

PPM type	ФНС-2	ФНС-5	ФНС-10	ПНС-5	ПНС-6	ПНС-8	ПНС-10
P, kPa	7,85-7,96	4,3	2,16-2,26	3,73-4,9	2,16-3,92	1,38-3,43	1,18-2,45

Gas permeability of ФНС porous strips varies within the range of 10-36 l/(min*sm^2):

Table.

Pressure defference ^p, MPa	0,025	0,05	0,075	0,10
Flow rate q, l/(min*sm^2)	10-19	19-29	27-33	29-36

The Titanium Institute (Zaporozhje) jointly with other R&D organizations has developed the technique for obtaining porous titanium parts, which are recommended for application in chamical, textile industries, metallurgy and other branches of industry.

Porous titanum parts of any required shape and properties may be produced by means of technique "tuning up". They found effective application as cartrige filters in different devices, breathers in floatation and sewage disposal installations, fire extinguishers. The parts may be welded by argon-arc, contact and diffusion welding, they are characterized by appropriate machinability. As compared with other types of PPMs, titanum parts have lot of advantages, including high strenght, corrosion resistance, inertness to biological media, low specific weigth (2.3-3.1 g/sm^3), possibility of repeated use with intermediate regeneration cycles. The economic effect from titanium parts application, counted in 1989 year prices, was as high as 50 to 150 thousand rub. per ton.

In Bielorussian Scientific and Manufacturing Centre for Powder Metallurgy the technique for manufacturing fine-bubble breathers from sintered titanium has benn developed. The breathers are intended for use in pure water ozonation systems. Previous experiments on use for that purpose parts, made from corrosionresistant steel (e.g., Х15Н9Т and Х18Р15), have failed due to their intence corrosion under influence of ozone-air mix. The devices for breathers installation into air system as well as technique for obtainig them, based on corrosion-resistance steel cold presing out, have been developed. There are several different variants of breathers fixing in casing, based both on flaring and gluing.

FORMATION OF THE ENGINEERS IN WATERSUPPLYING AND WATER EVACUATION SPECIALTY

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The problems of watersupplying and of Waste Water evacuation now has became actual for any country and society. At the early stages of urbanization in Russia having modest size of its towns and hamlets all the tasks of their supplying with drinking water and those of used water collection and evacuation were in the scope of responsibility of the engineers formed by High Technical Professional Schools and Railroad Transportation Colleges. Rapid industrial development and accelerated growth of towns in new Russia of twentieth reguired significant numbers of properly qualified specialists in the field of design, construction and maintenance of watersupplying and sewerage systems. So, at the Department of Civil Engineering of Moscow High Technical College was organized a Chair of Watersupplying and Waste Water evacuation. In the formed in 1921 Moscow Institute of Civil Engineering (MICI) there was created a specialty "Watersupplying and Sewerage Systems". The utility of such specialty was confirmed by the life itself as its basic principles, with only minor alterations and adjustments are valid up to now. In 1929 at MICI it was opened a Department of Watersupplying and Sewerage Systems which took a leading position in formation of engineers-constructors in this country. In 1964 it was founded a new specialty "Natural and waste Water Treatment Technologies" (1217) as further development of the above mentioned (1209). Systematization of the nomenclature of Civil Engineering specialties in 1988 merged the two specialties into a single one named "Watersupplying, Waste Water Evacuation, Rational Utilization and Preservation of Water Resources" (2980). On the base of the established in 1994 State Educational Standard for High Professional Formation this specialty obtained the name "Watersupplying and Waterevacuation" (290800).

The paper contains data on the development of specialty in the country as well as on its specializations connected with different areas of action of graduates from institutions of this profile; on the system of formation of the engineers and on their after-graduate refreshment; on the forms and variety of education; on the structure of educational plans; on the laboratory equipment and other auxiliary facilities for university education; on the methodical means and organization processes of formation; on the today's situation and the prospects of further development of the specialty.

VALVES WITH NEW CONSTRUCTION OF THE LOCKED ORGAN

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One of the basic types of the locked fittings are the valves. Their constructions are extremely varied. They are applied for shutting range of the pressure. The basic shortcomings of the valves are high values of the forces provided the shift of the valve locked organ because of high values of pressure forces held the local organ to the saddle (the pressure forces are in proportion to the pressure and increase as the square of the diameter) and the high values of corresponding friction forces which must be overcame to open the valve. This circumstance decreases the longevity and the hopeful of the seals drastically.

The first shortcoming may be obviated by supplying the pressure under the locked organ that leads to another undesirable affect, namely loading of the rod and glands.

The communication presents a new construction of the locked organ of the valve free from the mentioned shortcomings. It is hydrostatically unloaded and has special two-sided seal system. The seal system allows to use, for example, an elastic material not prone to wiping away (because of singularity of the construction). Both the seal system and the presented locked organ can be used in the valve constructions. In the last case there is no need to supply the liquid under the valve that leads to some advantages.

The communication includes

–the construction of the presented locked organ; the peculiarities of it's disposition in angular, skew and normal valves;

–the data of technological working out and a variant of weld valve;

–the characteristics and the results of operating experience of valves (d=50 mm and 100 mm);

–another parameters;

–experience of small series' output of the valves etc.

Taking into consideration the widespread use of the valves in many branches of industry one can expect the promoting of the presented variant of the valve will provide both high economic effect and great progress in valve's design.

REAGENTLESS DESINFECTION OF THE WATER BY THE PLANT USING CAVITATION GENERATOR

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The water desinfection methods can be classified into four basic groups:

1. Thermal (boiling of the water during 12-20 min.);
2. Using of powerful oxidizing agents (as chlorine, ozone, iodine, gypochloride sodium, chlorine dioxide etc.);
3. Oligodymanics (exposure of heavy metal's ions);
4. Physical methods (using of ultrasound, ultraviolet rays, electric pulses, radioactive emanation).

The chlorination method has some shortcomings. The main one is a formation of dangerous unwanted compounds, for example, toxic substance dioxine.

Other mentioned methods have some essential shortcomings too.

The authors believe that most promising, simple and universal method of desinfection of both natural and sewage water is artificial making of cavitation field in the water flow.

The cavitation field is making by generator including Venturi tube as a basic element. The cavitation generator is covered by patent of Russia.

The water desinfection plant includes a pump with an engine, cavities, pipelines, control devices, two cavitation generator mounted at input and output lines of plant.

The water desinfection plant is covered by patent of Russia.

The authors have worked out the method of cavitation generator's designing. The experimental plant was made and it provided some success while the trials using intestine bacillus.

The water desinfection plant can be mounted for required productivity (by parallel mounting of the generators, forming the plant's blocks etc.)

WATER SUPPLY AND ENVIRONMENTAL SANITATION SERVICES OF THE URBAN POOR, AN INSTITUTIONAL AND SOCIAL CHALLENGE

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Urbanization is progressing in all parts of the world and the supply of infrastructural services has not kept pace with the growth. Together with the urban growth, the number and proportion of urban poor is growing too. The challenge is, how to serve the urban low-income population with adequate safe water supply and environmental sanitation in a sustainable and affordable way. Conventional approaches meet institutional and financial problems when addressing this challenge. The present trend to decentralize and to commercialize the provision of these services is an improvement but not necessarily enough to cope with the huge demand. New partnership approaches, division of responsibilities and really involving the people themselves to improve their living conditions are needed. Institutional skills have to be developed to work in a new, different way; not only for the people but with them in a way which is based on a commitment to support people in their own efforts to improve their living conditions. Building-up management capacity of the communities, and changing the role of government away from provision of services to facilitating their provision is vital. This is not only an issue of technical or financial support but a comprehensive approach in which the government, from local up to national level, should take its proper role. Link between the various actors is crucial for success in improving the performance. The actors, it is the authorities, non-governmental organizations, community based organizations, non-profit organizations, private sector, and the people themselves, should communicate with each other and collaborate in their real capacity.

In order to achieve full benefits, the water supply and environmental sanitation facilities provided must function continuously, efficiently and to their full capacity. There is ample evidence that this has not always been the case, mainly because resources have been utilized for the planning, design and construction of facilities while operation, maintenance and management, including financial management, have often been neglected or conducted with inferior quality. Institutions providing the water supply and environmental services have not been run cost efficiently and their management structure has been inappropriate for the task. As a result, some water and environmental sanitation facilities are failing before their projected lifespan is over. Others are operating in an inefficient and costly manner. Benefits are not being fully obtained and scarce resources are being waisted.

Macro-economic developments have a major influence on the availability of public funds for urban water supply and environmental sanitation provision, because of the relative importance of national government funding of water supply and environmental sanitation. Lack of funds is always cited as the pri-

mary reason for lack of coverage and lack of maintenance. However, municipal/utility budgets are seldom independent or self-sufficient, i.e. where the utilities have to finance their operation and maintenance out of fees they have recovered. What they get from central government for operation and maintenance has no relationship with what is recovered, thus there is no incentive for cost recovery, neither for efficiency in operation nor maintenance.

Sometimes central governments decide on tariffs without taking local requirements for operation and maintenance into account, let alone the cost recovery of capital investment. The result is, that water supply and environmental sanitation systems are heavily subsidized and the subsidies go to the areas which are linked to the main infrastructure systems, not to the low-income urban areas.

The improvements in the water supply can be based on the assumption that the slum inhabitants are willing to and capable of paying for the services rendered. They are even now paying for the water as they have to rely on vendors to get the water. Quite often they also pay for sanitation services, emptying of their latrines or use of public ones. The price they have to pay is usually so high that it can cover the costs properly organized piped water supply and proper gunitation, provided the technology and the service level are adapted to the prevailing conditions. An essential factor here is that the stakeholders (former term: beneficiaries) are consulted early enough and that their genuine opinions are taken seriously and the systems designed for them and with them. The participatory approach should be developed further to a real partnership whereby the communities are involved in decision making from the start and whereby the type, level and number of facilities and involvement components are based on the priorities and demane of the community. If done so the responsibilities can be determined correctly and the beneficiaries, stakeholders will accept the cost implications of the improvements.

NEW TECHNOLOGICAL METHODS OF PRODUCTION AND UTILIZATION OF COAGULATING AGENTS ON THE BASIS OF NEPHELINE

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Purpose. Coagulating and flocculating purification of drinking water and industrial, municipal and agricultural effluents. Thickening of various types of mineral and organic suspensions.

Principle of action. The technology is based with acid of nepheling -bearing minerals turned out in huge quantities as a side product at mining plants of the Murmansk and other Russian regions.

Equipment. The process is distinguished by high performance and simplicity of equipment and based on standard equipment. Production of the reagent can be organized by the consumer who may both select the equipment of his own choice or use the standard design of the unit.

Maintenance. The plants can be operated both in periodic and continuous duties. A specific feature of the technology is the possibility of varying the range of products produced by regulating the regimes of nepheline treatment. The possible products are alumosiliceous coagulant-flocculant, purified coagulant, alumo-potassium and alumo-sodium alums, high-quality amorphous silica which can be used as a high-performance adsorbing agent and others.

Economic indices. Application of nepheline-based coagulants will permit a 2-10- fold reduction in expenditures on reagents for water purification in comparison with standard aluminium sulphate and other reagents. The payback period is 6 months to 2 years of the unit operation.

The degree of mastering. All the technological processes have been industrially tested. The technology of producing the coagulant-flocculant has been implemented at SC Apatit, where the reagent is used for thickening of apatite and nepheline concentrates and purification of circulating water at beneficiation factories and mine effluents.

The reagent has been successfully tested in treatment of drinking water in the cities of Vladimir, Pskov, St.Petersburg, Yaroslavl sewage of stick-raising farms, fish-processing, metallurgical, construction, mining, machine-building and other enterprises.

Distinguishing features and advantages:

- guaranteed performance,
- reliable equipment and simplicity of maintenance,
- low operational costs,
- possibility of introducing of other than suggested equipment and creating the unit by the consumer proper.

The technology is patented in the RF State Committee on Inventions.

AN ANALYSIS OF RAPID MIXING SYSTEMS BY USE OF AN INTEGRAL ENERGY BALANCE

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In a water treatment plant process train, rapid mixing is utilised in the coagulation operation as a part of the clarification process. The main characteristics of this operation are: high flowrates and high flowrate ratios of the mixture components (from 1000 to 10 000) and a need for executing the operation in the extremely short time.

The rapid mixing operation is accomplished by the use of different equipment such as agitated tanks, hydraulic jumps, jet ejector, dynamic and static in-line mixers. The primary aim of this work was to establish criteria for the energy efficiency, by the use of which a comparison of different units could be achieved.

Some authors showed that the common used criteria (G) or (Gt) are adequate in comparing mixers inside one group (Vrale, 1971. ; Meyer, 1985.). On the other hand, these criteria can not be successfully applied in comparing efficiencies of different mixing systems (Streiff, 1979.; Klute, 1985.; Mutsakis, 1986. ; Kalbitz, 1989.). Good design of the rapid mixing equipment can save capital cost of the treatment and chemicals, and give a better quality of water.

What we propose is the introduction of a general, on integral energy balance based, criteria which enables us to compare efficiencies of any kind of mixing units.

$$\Gamma_{TD}=\Gamma_{M}-\Delta\Gamma_{H},$$

$$\Gamma_{M}= Ne^{*}\,(Re_{m}^{3}/\,Re_{1}^{2})^{*}(d_{1}^{2}\,v/\,d_{m}\,S\,,w_{1}),$$

$$\Delta\Gamma_{H}= (1/Fr)^{*}\,(\Delta z/d_{1})+Eu+$$
$$+1/2[(\,Re_{2}/\,Re_{1})^{2}*\,(d_{1}/d_{2})^{2}\,-1],$$

where Γ is defined as a nondimensional measure of the power needed to mix a unit flowrate of water-chemicals mixture.

THE RISE OF THE QUALITY OF DRINKING WATER WITH THE HELP OF ADSORBENTS MADE OF THE LOCAL MATERIALS ON THE TERRITORY OF TURKMENISTAN

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During last decade significant attention is given for the rise of drinking water (DW) quality especially in the West Europe, USA and in the countries of CIS. The cause possibly is in the fact that it becomes more understandable that water is very important consuming product, and that the natural sources are becoming more and more polluted in the result of urbanization and industrial development.

Bad condition which occurs now in Dashkhovuz Velayat (district) which in its turn belongs to the territory of ecological disaster of near Aral Sea region. Because of the termination of water resources of Amudarya river (of only one water source in Velayat) and on the deterioration of water quality (rise of mineralization to 1.9 - 3.5 g/dm^3 and of the heavy metals, pesticides, phenols up to dangerous concentrations), sanitarico-hygienic and ecological situation in the region became extremely complicated and reached the crises one state.

In Velayat is extremely bad quality of DW. In Velayat's and Etrap's (small region) centres for supply with DW underground water is taken from the underbed and near canal lenses of fresh waters. This water slightly differs from polluted surface waters (soil filtration takes place). In the villages there live more than half (2430.7 from 4460.0 thou people) or 54.7% of population where water supply and canalization systems are absent. Population is forced to use water from irrigation canals or from wells, where waters are polluted by pathogenic microflora because of the contact with the fecal masses.

To receive DW of a good quality in the Desert Research Institute of Turkmen Academy of Sciences of Turkminestan on the base of local raw materials new adsorbents are created: modified argillite TU (technical condition) 303-90 UVEI 060.711.001, bentonite TU 303-90 UVEI 060.711.004, modified sulphocoal TU 303-90 UVEI 060.711.002, bactericidic bentonite TU 303-90 UVEI 060.711.005, bentonite "A" and "C", ceolite and others. On the two first mentioned adsorbents there was received the permission of Ministry of Health of USSR to use them as filtration mass while cleaning DW out of chemical pollutants and bactericidic bentonite - against bacteria.

In the result of the research it is estimated that affectivity of adsorbents in the process of cleaning of the waters out of chemical pollutants: pesticides, heavy metals, phenols, iron, radionuclides etc. So, modified sulphocoal cleans water out of chlorineorganic for 83-94%, methaphos - for 99-100% and modified argillite adsorbs rogor (BI-58) best of all - 99-100% and heavy metals. Modified argillite adsorbent cleans water out of DL for 40-73%, DDE - for 44.7-68.4%, phenols - for 99-100%, methaphos - 67.2-98.3%. Modified bentonite adsorbent cleans water out of DL for 50.2-65.7%,

DDE - for 50.1-65.0%, methaphos - 69.1-85.0%, phenols - for 80-90%. Absorption capacity of modified argillite adsorbent shows itself good in attitude to such elements as aluminium the percentage of retention of which ids about 65% to Cr - by 46%, to Mo - by 59%, to Pb - by 79%, to Zn - by 41%, to Zr - by 75%, and bentonite adsorbent in attitude to Cr, Cu and to Pb by 85%.

On the base of modified bentonite adsorbent more effective adsorption materials are created - bentonite "A" and "C", which demand to be checked in competent organizations.

THE TECHNOLOGIES AND CONSTRUCTIONS FOR DEEP TREATMENT OF THE NATURAL WATER WITH ANTHROPOGENOUS IMPACT

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The modern strategy of selecting technologies and constructions for the treatment of water coming from natural sources characterised high anthropogenous impact must provide:

- reinforcemennt of protectional function treatmental plants from ingredients, according to regilative of the Meeting SDWA Requirements;
- prevent the formation of dangerous toxic chloroganiccombinations (fiirst and foremost, chloroform and carbon tetra-chloride) because of the imperfect method chloridizing water;
- flexible techhnologies of different ingredients of multy-component system depending on the requirements and the same time save the expensive electrical energy, reagents and sorbent materials without the capital reconstruction;
- maximum-possibility use of pre-treatment in water resources before water plant processing.

The following technologies are applied in the world practice of water purification under the circumstances of an exceedingly high anthropogenous inpact over natural sources:

- When treating turbidity coloured water with chemical followed by sedimentation (or flock blanket clarification), filtration and disinfection, additional ozonation is envisaged prior to granular media filtration.
- When treating low turbidity coloured water primary ozonation is used to obtain flockulation effect and to ozonize organics prior to conventional facilities and secondary ozonation for water disinfection and odour removal.
- Heavily polluted water is subject to primary ozonation, sedimentation, filtration through inert granular bed, secondary ozonation and advanced treatment asorbtion on active carbons.

Complextechnologies and constructions are being elaborated and put into operation and inculcate in production in the Laboratory of Water Treatment of the SC RU NII VODGEO: with biological process of purificcation at the first stage, first and secondary ozonation, use of powde-like active carbons, chemical contact filtration through polimer and sand granular bed. All technologies and constructions of this type are patented.

SECTION III
WATER DISPOSAL

ECWATECH

THE DEVELOPMENT OF THE CENTRIFUGE FOR THE COMMUNITY DISCHARGE SLUDGES DEWATERING

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Approximately 30 years ago first centrifuges for the community discharge sludges dewatering were put into operation. There was the shortage of flocculants that are necessary for operation and, correspondently, the flocculants were expensive. Naturally, the producers and operators of the centrifuges strove for reducing of the "special costs on flocculants". Due to optimization of the process technology and the improvement of the equipment itself the reducing of the flocculant consumption was attained. Much later, in the middle of the 1980th, the attempts of the solving of this problem achieved the success. Following the new proposals to the market and the strengthening of the competition, during last 15 years the prices on flocculants not only remained invariable, but also decreased at 50-60 % in comparison with those of 1970.

Thus, there is no doubt that one should take into consideration not the special expenses for dewatering, but the special expenses for the utilisation of the sludges itself.

The dewatered cake volume reduction nowadays became the main problem. The necessity of solving this problem led to the development and creation of Centripress. By means of this installation the sludge dewatering to the dry weight quality became possible. Before the installation was put into operation such quality of dewatering could be achieved only by means of chamber filter-presses. But on the first steps, however, the installation(depending on type and size) consumed too much energy, having low productivity at the same time.

Several thousands of such type of installation have been already operating nowadays.

The further development of the Centripress-3000 during the last three years had the positive effect. So, if in 1970 the getting of dewatering sludges with the residual humidity of 75-80 % required the definite investment and capacity, today it is possible receive the dewatered sludges with the residual humidity of 65-70 % using the same investment and capacity.

The usage of Centripress-3000 allows operators of the purification plants to save 50 % of the expenses for sludge storage and to incinerate this sludge using no the additional fuel.

In case the necessity of the thermal drying of dewatered sludges Centripress can be transformed to centrifugal drier " Centridry " by means of additional conversions.

THE METHOD FOR REAGENT - BIOLOGICAL CONDITIONING OF MUNICIPAL WASTEWATER SLUDGE ACCOMPANIED WITH HEAVY METALS REMOVAL

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Municipal wasterwater sludge utilization as an organic fertilizer is either limited or completely excluded because of potentially hazardous elements sigh content. The purpose of the Method for Reagent-Biological Conditioning of Municipal Wastewater Sludge is to provide an economically efficacious sludge conditioning before its mechanical dewatering as well as to provide its utilization in an ecologically safe manner. The removal of heavy metals from sludge is performed though the dissolution and oxidation of hardly soluble heavy metals compounds and their complexes in acidic medium at pH 2.7-2.9 with the subsequent liquid and gaseous phases separation via mechanical dewatering.

The formation of the required phisico-chemical parameters of the sludge medium is achieved through the addition to the sludge of the sulfuric acid (10-15% maximum), water soluble iron forms (2% Fe maximum) and the maintenance of physiological activity of specific aerobic bacterial microflora. The duration of sludge conditioning treatment is 20-24 hours at the temperature of 23-27°C. The biomass recirculation is not required due to high bacterial growth rate. Functional bacterial microflora (Thiobacillus ferroozidans is the predominant species) is resistant to considerable changes of the medium parameters; its resistance is higher than the resistance of all the microbiological communities used at wastewater treatment plants.

The effectiveness of heavy metals removal or their concentration relative decrease in the dry matter of the sludge is determined by the initial heavy metals concentration in sludge as well as by the nature of a chemical element; for typical digested sludges it is as follows: Ni 70-90%, Zn 80-90%, Cu 30-80%, Cd 70-90%, Mn 80-90%, Co 70-80%. Reagent - biologically conditioned sludge is characterized by low specific resistance to filtration (20-45 x 10^{10} cm/g) and good dewaterability. The dewatering of this sludge with a membrane filter-press allows to achieve the water content of 63-72% (the dosage is 1.5 kg/ 1 t of sludge dry matter).

As a result of this conditioning the sludge phosphorus and nitrogen content available to the plants is not changed. The potassium content decrease is maximum 10-18 per cent of the initial content in

dewatered digested sludge. The toxic and potentially hazardous elements are separated and concentrated as solid phase compounds via non-reagent treatment of the liquid phase (filtrate) of the conditioned sludge. The amount of heavy metals containing sludge is 7-12% by dry matter of the sludge to be treated. The method was developed and examined during 3 years at laboratory scale and was successfully tested at Kurjanovskaya Wasterwater Treatment Plant of the City of Moscow using a pilot/industrial-scale plant of the output of $1m^3$/day. The pilot sludge batches of heavy metals low content were produced. The sludge was tested at a field scale. The crop capacity of agricultural products grown at the experimental fields was 1.5-2 times higher compared to soil non-fertilized with sludge. The increased content of toxic elements in the grains and straw of barley and oats was not detected.

The process may be applied at municipal wastewater treatment plants using traditional processing equipment and facilities. The protect the facilities containing the acidic medium (pH 2.7-2,9) it is sufficient to apply corrosion-proof coating. The introduction of this method at wastewater treatment plants will not produce adverse effect on the operation of the facilities for mechanical and biological wasterwater treatment and will not cause than the cost of flocculant conditioning prior to mechanical dewatering and is considerably lower than the cost of traditional treatment with lime and ferric chloride.

DETERMINATION OF THE INDISPENSABLE CLEANING GRADE OF THE SEWAGE AT DIFFERENTIAL REGISTRATION OF THE BACKGROUND POLLUTION IN THE WATER FLOW

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When determining the indispensable cleaning grade of the sewage using the actually accepted method, one usually operates in the calculations with the water flow pollution (in a general case of a reservoir) in a calculation range, i.e. in the range of the sewage outlet under consideration. Pollution grade is then accepted as the data averaged over the analysis carried out in the calculation range and it includes both the natural pollution and the anthropogenic pollution caused by the sewage outlet at higher areas. However, this procedure does not imply taking into account what part of the total pollution is due to some kind of the sewage or the flow itself.

As far as the pollution comes to the flow from various outlets, the self-cleaning rate is different and the times of reaching the calculated range and then the control point are different. Under these conditions, the flow consists of the reservoir's water itself and of the sewage mixed with the water. This fact should be taken into account when developing the calculation model.

The most important factor of this modelling is the registration of the natural flow condition at its various parts. For instance, if the flow is completely free from the sewage outlet (at least, along a sufficiently long length), its various parts are at the state when the pollution and self-cleaning processes are in equilibrium. If the equilibrium is disturbed due to any natural causes, the pollution concentration can reduce or increase.

As regards the pollution of the anthropogenic character, that will reduce owing the self-cleaning process. The most special self-cleaning processes in reservoirs are corresponded with the organic pollution mineralisation what results in the change of the biological admissible concentrations (BAC) and the chemical admissible concentrations (CAC). The change of the averaged BAC values (or their ingredients) of the flow at the calculation part prior to a control range should be calculated taking into account the every sort of the sewage entered at the parts situated higher than the calculated part, as well as the duration of the flowing, the specific features of the mixing and self-cleaning processes, the changes in the expenditure and other factors. For example, the mixing coefficients of the outlets of parts situated higher than the calculation one should be determined taking into account the total influence of the expenditure parameters, of the hydraulic and temporal factors along all the length from the the outlet point to the control point. At first, the sewage which entered higher than the calculation part will mix with the flowing water, and in the calculation range the sewage will be distributed in a certain ratio (the mixing coefficient could be more or equal to a unit). At the part between the calculation range to the control one, the newly entered sewage will be mixed with the mix of earlier sewage outlet and the flowing water. If the mixing coefficients for earlier entered sewage were less than a unit, the mixing process continues; this point should be taken into account. In addition, along the flow there could be the changes in the expenditure due to tributaries, separation into arms, water using etc. These changes could be taken into account with the help of the coefficients of the water expenditure and pollution inlet.

Basing on the system analysis of the discussed factors and of the differential registration of the interaction between the water and each separate sewage outlet, a mathematical model and the method for determining the indispensable cleaning grade of the sewage has been developed. The calculations carried out in the framework of this method showed that the registration of the total action of the sewage outlets upon the flow gives the greater discrepancy with the previously accepted

methodics, the reservoirs are cleaner (i.e. closer to the natural condition). For reservoirs under significant anthropogenic load, the discrepancy as regards the actual method is not more than 10-15 %. However, a higher cleaning grade is needed in all the cases.

THE ELECTROCHEMICAL PROCESSINF OF SEWAGE, CONTAINING CALCIUM CHLORIDE

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Calcium chloride is a multitonnage industrial waste. The plenties of sewage, containing calcium chloride, are formed at production of soda, hydrolysis of chlorinated organic compounds by the calcium hydroxide, making the water saltless in boiler rooms.

In the majority of cases sewage is not cleared and, falling to the sewage system, causes the amplified corrosion of pipelines and self-adjourment.

In usual conditions solutions of calcium chloride are not subjected to the electrochemical processing for the receiption of the target products because of shielding of the surface of cathode by the difficult dissoluble compounds, consisting of calcium hydroxide and calcium chloride.

The researches made by us have shown, that during the electrolysis of calcium chloride solutions in the diaphragm cell, the cathode chamber of which contains the solutions of sucrose, the process proceeds without formation deposit on the cathode.

On the platinic anode, ruthenium oxide electrode on the titanic base, platinized titanium, graphite gaseous chlorine is formed and hydrogen is formed on the cathode frome titanium or graphite. Calcium hydroxide in the cathodic chamber interacts with sucrase with the formation of saccharates of various structure. Calcium sacharate is a carrosion inhibitor in coling systems containing calcium chloride and sodium chloride. The existing way of the calcium sacharate synthesis by the interaction of sucrose with calcium hydroxide received by the decomposition of limestone at high temperature, is difficult and power-intensive one.

From the calcium sacharate being formed at electrolysis of calcium chloride solutions we precipitate calcium hydroxide, and the solution of sucrose is used ones more.

The electrolysis of sewage, containing the calcium chloride, in the cell without diaphragm and the reverse of electrical current results to the formation of solutions of calcium hypochlorite, using for the desinfection of water.

It is possible to receive the solition of the hypochlorous acid being used as the oxidative and chlorinative reagent at various synthesis from the calcium hypochlorite, precipitating the calcium carbonate by the carbone dioxide.

The kinetics and mechanism of allocation gaseous chlorine and hydrogen from sewage of soda production on electrodes from platinum, graphite, ORTA, platinized titanium, titanium have been investigated and the technological outlines of receiption of the valuable products frome sewage of boiler rooms have been developed.

CATION-ACTIVE FLOCCULANTS FOR PURIFICATION OF DRINKING AND WASTE WATER

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Cation-active water soluble polymers can be used to advantage for the solution of various technological problems, connected with speeding up the processes of sedimentation and filtering of suspensions, purification of drinking and waste water, enhancement of the output of petroleum strata. However, currently produced cationic polymers (among them polydimethyldiallylammonium chloride - VPK 402) are of relatively low molecular weight and this and as a consequence do not always meet industrial specifications.

In the given article, the copolymerization of acrylamide (AA) with the certain of cation-active monomers, namely dimethylamino-ethyl methacrilate sulphate (DM.SA) and dimethyldiallylammonium chloride (DMDAAC), has been studied for the purpose of high molecular polymers of catonic nature preparation. The flocculating activity of the copolymers synthesized has been determined. The copolymerization has been performed in concentrated aqueous solution under the adiabatic conditions. To choose the best polymerization conditions, the

method of statistical planning of the experiment has been employed. It makes it possible to obtain high-molecular water-soluble copolymers of DM.SA and DMDAAC under the adiabatic conditions. It has been found that using the technical solution of DMDAAC the rate of its copolymerization with acrylamide, as well as the molecular weight of the resulting co-polymers, can be increased on insertion of the complex additives or on increasing viscosity of the initial reaction mixture.

The polymers synthesized have been investigated as flocculants for drinking and waste water purification. It has been established that their flocculation activity is markedly higher than that of the industrial flocculants, i.e. hydrolyzed acrylamide and VPK-402. AA copolymer with DMDAAC exhibits a maximum flocculating activity in the range of doses from 1 to 3 mG/L, having the content of monomeric acrylamide units about 30 mol% and high molecular weight (viscosity =2/9 dl/g). AA copolymers with DM.SA are also effective flocculants in the above mentioned systems.

The extent of water purification required by the specifications can be attained on addition of 1 mG/L of AA copolymer with DM.SA, which contains 70 mol% of cationic comonomer units (viscosity=5.0 dl/G). It is of almost the same effectiveness, but shows a maximum flocculating activity over a wide range of concentrations.

Unlike the anionic polyacrylamide, acrylamide copolymers with cationic groups, that we have synthesized, posses high effectiveness at the desiccation of waste water precipitates. The application of these copolymers allows to increase ten times the precipitate water yields - the capillary suction time is herewith decreasing from 600-900 sec in the absence of the polymer to 60 sec on additions of 5-10 mG of the polymer to the suspense, containing 100 G of precipitate.

URBAN WASTEWATER REUSE IN SAUDI ARABIA

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Planning for reuse of wastewater for municipal purposes is becoming essential in Saudi Arabia for a veriety of reasons. The limited availability of fresh water supplies and the increased dependence in desalination make it more expensive to satisfy the growing water needs of the major cities and towns. The limited coverage of sewerage systems due to the rapid urban growth in the country during the last two decades has restricted the opportunities of re-using the generated wastewater. At present the total urban water supply in Saudi Arabia is estimated at about 3.33 million m3/d. Only about 1.15 million m3/d of this wastewater reaches treatment facilities and about 0.30 million m3/d of the treated wastewater is reused mainly for agricultural irrigation.

The paper intends to present the current reuse activities in the country with the emphasis on adopted wastewater treatment technologies, recycling and dual reuse systems, and urban reuse applications.

WASTE WATER OF ASTRAKHAN GAS COMPLEX (AGC) AND POSSIBILITY OF ITS REUTILIZATION

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Process waste water of Astrakhan Gas Complex runs through a system of treatment facilities including mechanical and biological treatment with activated sludge. Treatment efficiency is 30-60% by BOD, 40-60% by COD, 15-79% by oil products and practically satisfies all normative regulations.

At the same time so called "rain" waste water the quality of which is similar to a the quality of process water, has only intermediate mechanical treatment from oil products and is missed with biologically treated effluents that makes worse the quality of the total effluent stream.

The later is running to the gathering pond from where the water is taken for irrigation of agricultural fields during vegetation period. Generally, quality of waste water is within maximum allowable concentration for irrigation water except for chlorides con-

centration as mineralized water from boiler houses if running into sewerage.

10 years of irrigation with conventionally clean effluents caused mineralized water table rise and formation of technogenic lakes.

To solve this problem it is necessary to reduce fresh water intake and convert AGC facilities into a closed water supply system with highly purified effluent reutilization. With the existing water treatment system the reutilization without further treatment is feasible only for few purposes.

Circulation water major requirement is to limit water hardness, suspended substances and soluble salts content.

Mineralized waste water from boiler houses is foreseen to be utilized through the wash-out of underground reservoirs (storages) in Kungurian salt bearing deposits with discharge of salt water into former natural salt lakes. In the nearest future complete mechanical and biological treatment of "rain" waste water is proposed.

Advanced waste treatment is foreseen through ion exchange with the utilization of waster regeneration solutions as fertilizers. The plant includes filtration unit, adsorption filter, cationite/anionite filter with the capacity of 12000 m^3/d.

To reduce the load on adsorption filter it is necessary to reduce treated water COD from 100 to 10-20 mgO^2/dm^3. For this purpose biological treatment unit by immobilized microorganisms having considerable advantages over conventional systems and facilitating the stabilization of treatment processes is foreseen.

Thus, the proposed circulating water system will allow to reduce almost by half fresh water intake and water drainage to irrigation fields resulting in the reduction of adverse impact on natural landscape.

TECHNOLOGY AND A BIOPLANT FOR PRODUCING HIGH-QUALITY ORGANIC FERTILIZERS AND BIOGAS FROM MANURE AND DUNG

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In agriculture livestock farming and poultry breeding are known to use a considerable amount of water. Apart from animal and poultry watering water is used for process needs, including manure and dung hydroflushing and hydrotransport with the formation of waste water contaminating the environment and a considerable amount of money spent to treat it.

As an example, a 108 thous./yr pigstry complex requires 2500-4000 m^3 of water for manure hydroflushing and hydrotransport, about 25,000 kW-hr of electric power, approximately 6 tons of conditional fuel for processing 3000-4500 m^3 of manure effluent with estimated r 1,000 per m^3 of manure effluent processed.

In addition, an existing system for processing manure effluent over 20 percent of nutrient substance contained in animal excrement are lost.

Newly developed technology and a bioplant proposed fully eliminate the necessity of using fresh water for flushing and subsequent hydraulic transport of animal and poultry excrement from their location to further processing. According to the technology proposed animal's and poultry's pulp is fed to the bioplant, undergoes anaerobic fermentation with heating, is decontaminated and separated into solid (loose) and liquid (recirculate) phases. The latter being used again for hydroflushing and hidrotransport of excrement.

The use of the recirculate eliminates the necessity of using fresh water and a fertilizer produced almost all (95-97%) contained in excrement useful nutrient substances (nitrogen, phosphorus, potassium) are preserved.

Bioplants using anaerobic fermentation produce high quality loose and liquid organic fertilizers with no use of chemicals weed seeds, pathogenic micro flora, helminths and their eggs as well as fuel biogas and a protein/vitamin concentrate for protein-enriched formula feed.

Upon the customer's request bioplants are supplied in a variety of modifications, capacities and outfitted with appropriate equipment depending on the type and amount of feed stock and range of end products.

Bioplants are equipped with a sewer system for feed stock recycled hydrotransport delivery to processing from livestock and poultry farms to ensure environmental control, meet farm sanitation requirements.

PURIFICATION OF DRAINAGE WATER OF MINERAL DEPOSITS

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The exploration and development of mineral deposits produce considerable amounts of drainage water contaminated by different chemical compounds. Among them, one should mention the inorganic substances including the environmental toxicants referred by their sanitary-toxicological characteristics to 1 and 2 classes of hazard, i.e. heavy metals, arsenic, mercury, lithium, silicon, etc. The content of microcomponents is by 1 to 3 orders higher than the maximum allowable concentration (MAC) and they can migrate in the form of compounds, oxides and free ions.

Most of the existing purification facilities of mine and co-mined waters at oil- and gas fields provides only for the removal of suspended substances, partly organic contaminants, disinfection and neutralization. Such technological level of drainage-water purification is one of the reasons for growing degradation of water quality in water bodies.

Anomalous concentrations of chemical components and their high amounts in drainage water enables the latter to be considered as a hydromineral resource. Annual discharge of chemical compounds with waste water produced only by galurtic manufactures is more than 6 mln. t to a total cost of over 150 mln. rbls (in prices for the year of 1984). The economic loss from the dischargeof such solutions to open water bodies amounts to about 25% from the basic production.

Utilization of chemical compounds of drainage water requires the development of effective technolody for the extraction of commercially useful products. The solution of the problem of integrated processing of mineralized solutions includes a complex of chemical-technological, environmental and technico-economic investigations. The amount of chemical-technological investigations is determined depending on a concrete practical task, nature of a study object, methods of obtaining final products using available reagents. Environmental investigations are aimed to develop the measures on decreasing the anthropogenic load on the environment taking into considiratoin the sanitary standards and regulation. The technico-economic of the problem is connected with instrumentary possibilities, comparison of amount and variety of finished products with the demands of market and its state.

Selection and efficiency of water purification methods are limited, as a rule, by total mineralization, concentration of useful and toxic chemical elements, amounts to be treated, local climatic conditions and infrastructure of a region. Technological regulations are worked out for different types of water, based on using reagent-, sorption-, extraction-, electrochemical and membrane methods. A possibility is shown how to extract from solutions the alkaline and heavy metals, boric acid, iodine, bromine, magnesia, sodium chloride and other chemical compounds.

The technological regulations are defined more precisely in the course of in-situ tests. Technology of integrated treatment of drainage water was tested at the fields of Ural, Far East, Fore-Caucasus and Middle Asia. The analysis of the proposed technological solutions was used as the basis for technico-economic estimates, the calculation of exploitatoin cost for purification of water with simultaneouse obtaining chemical products.

THE INFORMATIVE PROSPERITY OF THE PROBLEM "WATER: ECOLOGICAL AND TECHNOLOGICAL ASPECTS"

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The increasing crises of the drinking water, the importance of the problem of ecological security in the field of industry, energetic and agriculture demand the operative excellent information on this problem.

The electronic data base "The technology of waste water purification" has been made in VINITI on the bases of the analysis of world science and research information, on the demands of the users: chemists, sanitary doctors, engineers, administrators, dealing with ecological problems.

Data base uses the materials from 52 countries mainly from SNG, USA, Germany, published in 29 languages, most of them are published in English and Russian. While preparing Data base the so-called "second information", containing the information about publication and the structure and growth of the world "first information" is used. While forming the information fond the integration of ecological information on different kinds of science and technology are always made. Annually VINITI works with more than 100000 documents of ecological information. The criterion of the choice of the documents to Data base is their topical and scientific novelty.

Data base includes the materials of the technology purification of natural and industrial waste water (chemical, oil, oil-chemical, metallurgical, cellulosical-paper, fooding, lacquer-paint, galvanic and others), common infiltrates, sediments and utiliza-

tion of waste water. The information about the legislation and the norms and expenditure in the field of waste water and sediments purification are also included in the Data base.

Analysis the information from the last 2 years sees the growth of the investigation of the biological methods of the waste water purification, the technology of the drain purification of galvaniq, getting the new kinds of sorbents and high selective extragents, removing N and P.

Data base "The technology of waste water purification" consists of bibliographie description and annotation and gives the search on: - the name of the article, - authors, - source, - key words, - rubricators.

Data base is given on the diskettes. On the basis of this Data base VINITI has made the new series of the collection "Water":

- "The technology of purification. The compounds of N and P"
- "The problems of small population points"
- "Oil. Fat. Butter. Separation and utilization"
- "Heavy metals. Separation and utilization"
- "Analysis"
- "Water preparation"

The issues have the subject index in Russian and English.

The users may get the issue in traditional publishing form and its electronic analog, and also Data base of the issue on necessary subject.

This work has been made in VINITI on the financial support of the Ministry of environment protection and natural resources RF.

DISPOSAL, TREATMENT AND REUSE OF PLATING WASTE EFFLUENTS FROM MACHINE AND INSTRUMENT ENGINEERING ENTERPRISES

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Waste effluents from plating operations being discharged into receiving streams contain significant quantities of heavy metal salts and toxic constituents: cyanides, chromates, fluorides, acids, alkalies, synthetic surfactants, oils, that have adverse impact on the state of water bodies.

Discharge of plating waste effluents to municipal sewer systems causes disturbances in biological treatment systems and leads to the accumulation of metal ions in organic sludges, thus creating problems in their utilization and storage.

More efficient usage of water in washing operations resulting in reduced wastewater flow rates and concentration of electrolyte's components in them, is accomplished by improving methods and schemes for product washing.

As a result of long-term research and practical experience flow sheets for disposal and treatment of plating waste effluents have bee developed and are used providing separate removal and treatment of local streams according to components present in them and concentrations of pollutants.

Up to the present units based on chemicals usage are most widely applied to the treatment of such wastewaters.

Sludges produced are dewatered and hauled for disposal and storage.

Such technologies being reliable, however, have a number of disadvantages. The main are secondary pollution of water caused by increased concentration of salts which prevents its reuse, as well as the impossibility to achieve residual concentrations of metal ions satisfying current requirements to treated effluent quality.

In a number of cases to meet the requirements they require advanced treatment which should be fulfilled without basic upgrading of existing facilities. For this purpose NII VODGEO has developed technology ensuring residual concentration of heavy metals in the treated effluent within the range of 0.01 - 0.001 mg/l. It involves additional separation of rediual metal ions into solid phase when they interact with highmolecular sulfur-containing chemicals.

In recent years development of treatment systems for plating waste effluents that produce effluents reusable in production processes is the main way to solve the problem. Units for effluent desalination are the main components of such systems. Free-chemicals technologies preventing salt concentration increase in wastewaters are being developed and introduced.

To detoxify cyanide-containing wastewaters there have been developed efficient processes and units for their electrochemical oxidation, catalytic oxidation by ozone, oxygen, hydrogen peroxide.

Efficient chemicals-free treatment with chrome-containing wastewaters is achieved by means of technologies based on electrocoagulation or galvanochemical method.

The basic term in the development of wastewater treatment systems ensuring their reuse, is separate disposal and treatment of diluted wash waste effluents and spent concentrated solutions. Recovery of such solutions with utilization of valuable components is the most retional solution.

A number of technologies and units have been developed for this purpose. The majority of them

are based on electrochemical, chemical, ion exchange methods. In addition to the recovery of inorganic acids and alkalies, these methods allow to obtain metal deposits at a cathode, crystallized salts and other valuable components.

However, universal methods and units providing complete solution to problems of wastewater treatment, their reuse and valuable components recovery, don't exist. Therefore, depending upon pollutant concentrations, wastewater flow rates, requirements to treated effluent quality, it is reasonable to employ process chains of separate units, that are manufactured in the form of modules. Their application jointly with technologies being modified and reducing wastewater flow rates and electrolyte component carry-over will permit to get better results.

CONSTRUCTIONS MADE OF RUBBER COATED FABRICS IN REGULATION OF WATER QUALITY AT WATER OBJECT

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Using of water resources is connected with selection and escapage of considerable volumes of water. It demands working out of the constructive measures directed to lowering of pollution level, biological productivity rise (fish reproduction), making difference in economic using of water object, etc.

As a result of many years research rubber coated fabric constructions proved to be a promising field in organising water conservation echnologies and in creating new constructions for some technological schemes.

The main part of the construction of such type is a flexible screen made of synthetic ubber coated fabrics.

The working position and functioning of the flexible screen are supplied with the systems of the surface and tube floats. The floats are held up at the given range of the water area by the bottom anchor devices.

Rubber coated fabric constructions can be used in the following technological schemes in water conservation:

- system of technical water supply at thermal electric and atomic stations;
- systems of irrigation (head water offtake departments, main canals);
- fulfilling works on water surface (output of construction materials and bottom deposits, building of end piers under bridges, etc);
- differentiation of economic using at water reservoir (building of botanical sites, production of food fish, etc);
- restoration of evtrophic and dystrophic water reservoirs;
- damage escapage localisation of polluting substances (oil products, phenol, etc.);
- restoration of ecological balance of delta sections in rivers and estuaries;
- liquidation of extra ordinary situations connected with backwater constructions.

As a result, the rubber coated fabric constructions are used as inlet devices at the technological schemes of electric and atomic stations. They supply water in layers. This saves fish up to 70%.

The escapage and distribution of heated waters, along the area of water reservoirs are made by rubber coated fabric constructions. They have functions of jet distributing and jet directing of heated water. The constructions supply the given temperature regime.

In technological schemes of restoration of evtrophic and distrophic water reservoirs rubber coated fabric constructions are used to make running water along the of shore zone of the water reservoir, to saturabe the lower layers of water by oxygen, to create circular flows and water exchange in the water reservoir and soon.

The results in production tests of the rubber coated fabric constructions in water conservation technological schemes, in technical water supply systems at electric and atomic stations, at main water intake of irrigation systems, in constructing fish tanks for breeding fish at shallone water sections of water reservoirs proved to have full accordance with theoretical and experimental research.

The effectiveness of the constructions used only as offtake water constructions is determined by decreasing of getting fish (up to 70%) into the systems of technical water supply at electric stations, decreasing of fuel expenses (5-7 grams) for producing of 1 cwt/h of electric energy.

INTENSIFICATION OF AERATION PROCESSES IN NATURAL AND SEWAGE WATER PURIFICATION METHODS

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It is known that aeration processes, their main function being saturation of water with oxygen, take an important place in water treatment and sewage water purification procedures.

In domestic and world practice of water treatment, water aeration is carried out in special devices: pneumatic bubbling-, sprayind-, cascade- or blade-type aerators working on the principles of feeding "air-into-water" or "water-into-air".

The following should be considered as the general drawbacks of the said aeration methods: (a) low coefficient of oxygen dissolution in water despite considerable air consumption ranging up to tenth of cubic meters per 1 cubic meter of water; (b) large industrial spaces, high capital costs and energy consumption; and (c) considerable consumption of metal and complexity of the devices.

To our opinion, the main reason for low work efficiency of the existing aeration devices is insufficient realization of capabilities of mass-exchange processes in the system "liquid-gas".

The hydrodynamic fundamentals of intensification of gas-liquid mass exchange in reference to water systems aeration processes have been developed at the Institute of Mining. The problem of fine homogenization of water-air medium in special dispersing devices with formation of highly expanded "water-air" phase interface which enables more complete and quick saturation of water with oxygen in comparison with all known aeration methods has been solved.

The mechanism of oxygen dissolution in water has been explained with allowance for hydrodynamic factors and basics of turbulent diffusion and the process kinetics have been revealed.

On this basis, the procedure and equipment for intensive aeration of water media have been created the use of which ensures:

(a) 5-10 times lower consumption of air required for aeration;

(b) tenths of times less metal consumption;

(c) 30-40% less industrial area;

(d) work without external feeding of air.

The most worth-wile application areas for the procedure are the following: stabilization treatment of ground waters, removal of iron from water, degassing of water (removal of hydrogen sulphide, free carbon dioxide and metal), biological purification of sewage water.

THE ECOLOGY SAVED TECHNOLOGY OF THE WORKING OF CITY'S WASTE WATER INTO MINERAL FILLER FOR ASPHALT CONCRETE

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The city's waste water (SWW) is big quantity waste material which very difficult to use because SWW contains a salt of hard metal. The most real way of utilization of SWW is using it in road construction.

Byelorussian State Polytechnic Academy and PO "Minskvodokanal" worked out a technology of mineral filler for asphalt concrete with using of SWW. This technology consists of mixing of SWW with burnt moulding sand, their common heating and milling. This technology guaranty the fix of the salt of hard metal on the fresh surface of mineral miller and blockade one by bitumen in asphalt concrete.

Investigation of toxicologes activity of filler and migrations of salt of hard metal into environment shown an ecology safety of this technology.

Industrial test shown a practical acceptable and economic effect of new technology. The positive result allow to start a build of an industrial equipment for the working of SWW of PO "Minskvodokanal" and burent moulding sand of Minsk tractor's factory with producing about 10.000 tonn of filler per year.

TECHNOLOGICAL PROCESSES OF WATER PURIFICATION NEW METHODS OF CONTROL AND MANAGEMENT

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Conventional methods of water purification are coagulation, flocculation , sedimentation and infiltration. These methods are based on variations of suspended matter concentration, its corrosive resistance, sizes and forms of particles as well as their density. Hence prompt management of these process should consist in continuos automatic control over principal technological indicators of treated water quality, these data characterizing the essence of each process separately.

With this aim in view the Vologda Polytechnical Institute has developed a set of express methods and devices of technological control over water quality.

To determine corrosive resistance of suspended matter we suggest a procedure of quick measurements of electrosporetic mobility of this suspended matter and automatic zeta-meter.

For express control over coagulation and sedimentation two methods of sedimentation analysis have been developed, these methods allowing to determine granulameter composition of suspended matter at any given moment, as well as predicting its change in the process of coagulation.

Two designs of turbidmeters for express control of suspended matter concentration have been developed. One of them is able to measure concentration in the wide range of measurements where as the other one is meant for particular precise measurements of low concentrations at the water outlet from purification plants.

Major part of developments carry author's certificates: NoNo 1116363, 1226174, 1239557, 1363020, 1377705, 1383190. Application of new methods and devices allows to optimize water purification processes in existing technological schemes to make them adaptable.

THE EXPERIENCE OF INTRODUCTION OF THE ADVANCED DEWATERING EQUIPMENT AT MOSCOW WASTE WATER PLANTS

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The generation of huge amounts of sludge at Moscow waste water plants, transportation for long distances, lack of areas used for landfilling put certain constraints in choosing the dewatering equipment. The main criterion is the maximal sludge dewatering at minimal chemical costs.

The out-of-date vacuum filters which have been in operation for a long time will be replaced in the next two years. Beginning from 1985 PF-POB Polish-made chamber filter presses have been successfully used at Kuryanovo waste water plant. The average moisture content of the dewatered sludge was 65% at the dosages of ferric chloride and lime 5% and 25%, respectively. However, actually these filter presses have been worked out by 1995. The need of fast transition to more economical conditioning with organic flocculants became obvious.

Kharkov NIIKHIMMASH Institute designed an original chamber filter press which is manufactured by Progress factory in the city of Berdichev. The operation of these filter presses at Lyubertsy waste water plant revealed a number of serious drawbacks of the design and manufacture which result in numerous failures.

Within two years from 1992 to 1994 Mosvodokanal carried out industrial-scale tests of different dewatering equipment: belt filter presses, centrifuges, centrifuges with sludge pressing (centripresses), membrane chamber filter presses. The tests showed that the only dewatering apparatus of high capacity which can meet the demands of our waste water plants and provide for the sludge low moisture content similar to filter presses is a centripress. However, centripresses censume much flocculant for conditioning (7-8 kg/t of dry solids compared to 3.5 - 4.5 for filter presses). Filter presses have a simple rigid design with a few moving parts (only a plate shifting mechanism) and ensure higher sludge dry solids. One of the most important advantages of filter presses is their non-sensitivity to high sand content.

Beginning from 1995 Mosvodokanal has been implementing large-scale upgrading of sludge dewatering process introducing membrane chamber filter presses. Last year 4 old Polish filter presses at Kuryanovo plant were replaced with 2 Italian Diffenbach units and 2 German Netzsch units. The plates are 1.5 by 1.5 m, the chamber has a capacity of 5.7 m^3. The results of operation showed high reliability and efficiency. The utilization factor was more than 0.95; 17 filter runs per day, 750 m^3 of daily processed sludge, about 65% moisture content (with the addition of flocculant.

In June 1995 Mosvodokanal held a bidding with the participation of world biggest manufacturers of filter presses. The bid winner was Diffenbach company from ItalyBefore July 1996 Mosvodokanal is planning to replace two more filter presses at Ku-

ryanovo and put into operation two big units at Lyubertsy with 1.5x2.0 m plates and 11 m^3 chamber capacity.

Mosvodokanal is planning to provide for 100% filter press dewatering of sludges by the year of 1998. To meet our own needs and partially satisfy the Russian market Mosvodokanal will start joint production of filter presses in Moscow in 1996 with the help of a joint venture which will be established.

COMPREHENSIVE PURIFICATION OF WASTE WATER DEFERRIZATION OF DRINKING WATER

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GosNII "KRISTALL" has a long-term experience in scientific-research and pilot-scale design works on purification of waste water with different component composition.

With the aim of conversion of scientific and engineering activity of KRISTALL and for realization of engineering designs in the field of environmental control the department for production of БТУ 0,5/2 tubular ultrafilters is established. 5 Models of БТУ 0,5/2 ultrafilters for industrial and food facilities are manufactured: БТУ-0,5/2, Ф-1, Г-1, УП-ПС, УП-Ф.

Ultrafiltration units with БТУ 0,5/2 ultrafilters for regeneration of waste washing solutions (WWS) are produced with the throughput from 0.3 to 2.5 m^3/h. Filtrate is reused and concentrate is processed in a centrifugal equipment (a separator). Saving in washing agents is 90%, removable mineral oils correspond to approved standard ГОСТ 21046-86 "Waste oil products'. Similar units are manufactured for purification of waste lubricating and cooling liquids (LCL). Purified water and oils may be used for making fresh LCL.

The units for regeneration of WWS and separation of LCL are installed at Joint-Stock company "Pavlovsky Avtobus".

The ultrafiltraion units are advisable to use at the first stage of purification of heavily contaminated waste water of food facilities: shops for processing agricultural production, confectionery factories, fish smoking shops, integrated works for processing meat et al. At this demand in oxygen are provided. Subsequent purification of ultrafiltrate in a bioadsorber provides the water with the quality which meets the requirements of sanitary morns.

There are design plans and specifications for the unit with the production rate of 1.2 m^3/h.

Treatment of secondary raw material of milk, for example whey, is a separate problem. At present only 65% of milk components are used, In Russia the market of milk sugar is almost absent.

Application of ultrafiltration allows to solve the problem of whey purification. Albumen concentrate received by ultrafiltration may be used for making food products(curds, cheese et al) and filtrate (clarified whey) for receiving milk sugar.

Clarification of whey using ultrafiltration was tried out in pilot unit with БТУ-0,5/2 Ф-1 at the diary factory in Dzerzhinsk. The production rate for filtrate was 700 l/h. Considerable advantage of tubular ultrafilters for clarification of whey in comparison with flat frame or roll elements is the increase of the period between regenerations up to 26-32 hours and the decrease of the time for washing membranes up to 2 hours. For flat membranes these periods are 4-6 hours and 4 hours respectively.

As for treatment of clarified whey the most sugar by low temperature crystallization was developed and tried out. In comparison with the traditional method (treatment with acid and evaporation) the method of crystallization is more cost effective due to reducing of power consumption by two times.

In some regions of Russian Federation there is an acute problem of deferrization of drinking water. Traditional methods of deferrization of water include aeration for oxidation of Fe^{++} to Fe^{+++} and filtration using porous partitions in dead-ends or sand filters.

KRISTALL developed a promising process of deferrization of water by membrane microfiltration in tangential mode of preliminary aerated water. The production rate of filtration is 80-100 $l/m^2 \cdot h$ under the pressure of 0.2-0.3 MPa and at the linear velocity of flow of 3-4 m/s.

The remaining content of ferrum in the filtrate is not more than 0.1 mg/l that does not depend on the initial content of ferrum. The method is characterized by a stable results of purification, simplicity and compactness of the unit, possibility to concentrate ferrum hydroxide for subsequent utilization.

A pilot unit was tried out in the town of Noyabr'sk in Tumen Region.

For purification of waste water containing oil products it is suggested to use bioadsorber with combined charge consisting of polymeric material (for example of Polyvom) and granular activated carbon.

Purification of waste water is carried out in aerobic conditions by biolfiltration with the rate of 5-10 m/h (a linear velocity) and 0.5-1.5 h of residence time through a stationary layer of the charge with microorganisms cultivated on its surface. Adaptation period of microflora is 3-5 weeks. Residual content of oil products is not more than 0.05 mg/l when the initial content is 10-24 mg/l. For regeneration of the charge it is enough to remove excess activated sludge at increased consumption of air. An interval between regeneration is once a year.

Dimensions of a unit with the capacity of 20 m^3/h are 3.6 m in diameter, 3.6 m in height, 2.7 m of total height of the charge.

the advantages over bioadsorption with pseudo-fluidizes bed of the charge:

– simplicity of bioadsorption and control of the process,

– there is no abrasion of carbon grains,

– conditions are provided for selection of microflora specific for each area of bioadsorber that provides high efficiency of water purification.

ESTIMATION OF THE POSSIBILITY TO USE UTILITY-HOUSEHOLD WATERS FOR REPLENISHMENT OF WATER RESOURCES

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The existing technologies of municipal wastes treatment, as a rule, do not provide their guaranteed treatment adequate for their repeated use. Alongside with the technological engineering methods of wastes treatment the use of underground collectors as means for natural water preparation is of interest. Therefore, a comprehensive final waste waters treatment was studied followed by filtration through ground sand collectors.

The dynamics of the qualitative composition of waste waters was studied in succession along treatment stages: following the main block of biological treatment; following the block of final treatment or rapid filtration; following slow filtration in sand collectors.

At the 1-st stage (the traditional scheme)it was found out that as far as BOD_5, content of ammonium nitrogen, particulate matter, iron and coli-index their residual quantities exceeded the values allowed for the repeated use of those waters.

2-nd stage of treatment, having allowed to a greater degree to decrease the amount of nitrogen-containing compounds and the BOD value, did not significantly increase the efficiency of treatment facilities functioning: waste waters did not reach the requirements of GOST (State Standard) 2762-84 and SaNPiN (Sanitary Rules and Standards) 4630-88 according to microbiological (coli-index - up to 10^6, total microbic count - up to 10^4 u/ml, Ps.aerogenosa - up to 10^3 cells/l) and chemical (chloroform - up to 600 mkg/l, turbidity - up to 20 mg SiO_2/l, iron - 2.9 mg/l, COD - up to 50 mg O_2/l, permanganate oxidation - - up to 6 mg O_2/l) indices.

On the basis of results of treatment at the 3-d stage 5 groups of parameters were identified which are united by common processes and factors and which are the most important in the process of wastes treatment during filtration. The developed classification includes nitrates, nitrites, BOD_5 (the 1-st group), COD, SAS (the 2-nd group), phosphates, iron (the 3-d group), coli-bacilli (the 4-th group), particulate matter, turbidity (the 5-th group).

The dominating role in changing of the 1-st group indices was played by biogeochemical processes which were manifest due to the presence of silt-containing residue on the surface of a sand collector, and resulting in the decrease of concentrations of nitrites, nitrates and BOD_5. The dynamics of indices of the 2-nd group is also predetermined by the biogeochemical processes, however the efficiency of wastes treatment according to those indices was a little lower. Phosphates and iron, attributed to the 3-d group, can be accumulated by various kinds of microorganisms, but, besides, contrary to the mentioned above substances, they can be sorbed by sand. Intensive isolation of coli-bacilli (the 4-th group) was observed 25 days following the beginning of the filter cycle due to the formation of a certain biochemical medium in the upper 10-centimetre layer.The treatment effect was 95-98%. Particulate matter and turbidity belong to the 5-th group: contrary to rapid filtration slow filtration in sands lead to complete adsorption by the surface layer without deep sedimentation.

As result of the suggested scheme of deep final waste waters treatment waters were obtained which met the requirements of GOST 2761-84 "Sources of Centralized utility-household Water Supply" for water reservoirs of the III class.

AIR DIFFUSERS OF NEW GENERATION

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Testing of up-to-date high-effective and energy saving aeration systems is highlighted in the paper.

In treatment facilities up to 30-40% of capital investments and 70-80'% of power are consumed by the air supply systems thus causing a constant need in the enhancement of the aeration system efficiency.

The replacement of medium- and large-size air bubble diffusers by fine-bubble ones provides the efficiency improvement approximately 2 times. However, such diffusers possess a significant disadvantage as in the process of their operation the pores are getting clogged thus resulting in the growth of head losses and leading to frequent re-

generation of the diffusers or even to their complete replacement.

The primary trend in the improvement of the fine-bubble air diffuser operation is the application of such modern materials as cermet, products of powder metallurgy, foamed polyurethan, polyethylene, synthetic fabrics, fiberglass and others for manufacturing air dispersers. These materials improve the strength of air diffusers and facilitate their regeneration. However, in case the materials used have a rigid porous structure and are water repellent, their clogging cannot be avoided.

The air diffusers of new generation have been developed and used on a broad scale abroad. They ensure a high degree of air dispersion (1-3 mm bubbles), low head losses (0.2-0.3 m of water column) and are less subjected to clogging, in particular disc diffusers with the air dispersers in the form of polymer membranes with the perforation made by a laser ("PASSAVANT", "AIRAM",etc.).

In our experiments a "PASSAVANT" disc air (USA) was taken as a prototype standard for a comparative assessment of home-produced disc diffusers provided with the air dispersers made of modern materials (cermet on the basis of bronze and titanium grit, polyethylene and resilient synthetics). The latter are manufactured by the "GREEN FROG" firm (Russian Federation). The resilient material used possesses a well-developed fine-porous structure (all pores are open), uniform pore size, high resistivity to chemical and abrasive material effect, low specific gravity and good wettability.

The experiments were conducted in standard conditions in compliance with the standard methods. They showed the advantage of the prototype over the majority of the diffusers tested, with the exception of the "GREEN FROG" ones, the technological parameters of which are similar to those of the prototype at low air flow rates and even more advantageous at higher air flow rates (over 3-4 m^3/h). The "GREEN FROG" diffuser is less subjected to clogging and despite of the less working surface has a wider range of capacities.

The experiments revealed the following.

Among the common disadvantages of the air diffusers equipped with air dispersers on the basis of cermet and power metallurgy one should note a sufficiently heterogeneous porosity as a result of which the surface of the diffuser cannot be completely used, and a sharp growth of head loss with the increase of air flow rates which determines a narrow range of capacity.

The diffusers with the air dispersers made of high-density polyethylene possess the same disadvantages as listed above. At the application of low-density polyethylene the diffusers have a low degree of air bubble dispersion (over 3 mm) and are unsteady in operation.

The advantage of air diffusers with the elastic air dispersers ("PASSAVANT", "GREEN FROG") has been ividly proved. The head losses in these diffusers grow not so harply as in the diffusers with rigid porous structure. Besides, these air diffusers are less subjected to clogging.

The parameters of the "GREEN FROG" diffuser's operation have been established in pilot plant conditions as follows:

- the capacity range:
- operation - 2-20 m^3/h;
- optimal - 4-8 m^3/h;
- head loss - 0.1-0.2 m of water column;
- effectiveness of atmospheric oxygen utilisation -16- 25 %;
- oxidation power - 50-85 g O_2/h;
- power consumption - 0.5-1.1 KW.h/kg 02;

The resistance to clogging results from elasticity and wettability of the material the air disperser is made of as when clogging the pores are getting expanded and the clogging particles are removed.

The "GREEN FROG" air diffusers have been installed and demonstrate a successful performance at various treatment facilities of Kazan, Nizhny Novgorod, Rybinsk, Pravdinsk and other towns.

Proceeding from the results of testing the "GREEN FROG" air diffusers can be referred to aerators of new generation.

BIOPURIFICATION USING FOR STRONGPOLLUTELY CHEMICAL SEWAGE

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An unquality (or an absence) of purification systems causes high concentration of chemical pollution in sewage yet at many enterprises or their separate shops. The present developments are designed for use in clearing of strongpollutely (including multicomponent) sewage, when known methods (oxid. coef. up to 40 g/l, nitro-, chlorinephenols, other aromatics, complex kethons, cpirits, synthetic acids, petroleum and other) are inefficient. The technology realizes in local facilities with a purifieng degree, enabling to send leaving waters to typical purification construction.

Specificity of this pollution produced a peculiarity in bioprocess development and realization, such as: selection of strongstable for toxic sewage strain associations, immobilization of cultures for their stability increase, biopurificational process and equipment research technique, modeling, scaling and pilot testing in real plant conditions, technique of necessary biomass scale production and start of biopurificational process. For the control of association growth intensity in biodegradation process there was used a developed method for the analysis by the pO_2 detector.

Long (more than 2 years) exploitation of designed industrial facility for the solvent shop sewage clearing (cethones, toluene...: more than 10 substances, oxid. coef. up to 40 g/l, aK up to 10.0) shown efficiency and bioconversial stability of compounds (for 60-100%) in this condition at one-step purification.

The developed approaches can be used for creation of biopurificational processes of strongpollutely chemical exhaust gases, soiles, basins, and for working intensification of industrial purificatory constructions on particular groups of harmful compounds.

THE APPROCHES TO MODELING AND ACCOUNTS OF BIODESTRUCTION TOXIC SEWAGE PROCESSES

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Parameters for processes microbial destruction of toxic pollution find by empyrical methods, because we often haven't much information about methabolic pathway of toxic substunses and microbial cells growth on it.

Methods for purification sewage water has developed in this work. It gas: 1) for main research parameters choice. It includs: initial concentration of pollution, degree of purification by one step, volume and height of bioreactor and filter; 2) choice optimal conditions for activity microbial population based on measurement its respiration; 3) use many dimentions biofilters needed for scale accounts; 3) choice math models for adequate description processes purification sewage water; 5) creation of pilot systems based on researched processes.

The offered approaches permit in short time (about one year) to create biodegradation technology of pollutional multicomponents and toxic sewage. Tests have sucsessfully complited in real plant conditions. For comparative analis foreign and domestic account methods are applied in this work. Some account algorithmes was realized in computer programs.

BIOPURIFICATIONAL APPLICATION OF BIOMASS MATERIALS-CARRIERS

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For effective functioning of biological purification systems (biofilters) important parameter is suitability of a filliner material as a biofilm carrier. In the practical purposes for clearing chemical sewage, oilingwaters there was made selection of bearer materials by parameters as specific mass, volumetric surface biomass sorbtion for target microbial associations.

Among widely used building materials, ceramics bearer, foam-polymers by specific sorbtion the keramzit was better (better for 30-220% that other samples). An partial absorbial ability of chemical substances from drains gives uniformity to biofilter working. The choice of keramzit (40-60 mm) as the biofilm carrier was confirmed by successful long testing of toxic sewage biodegradation facility at the chemical enterprise.

In connection with sharp rise in building material prices among other groups of the goods there is represented economically perspective application at CIS of polymer materials, including maded with secondary resources. So, we offerd and investigated some carrier samples as a kind formstability elements with various polymers (poliolefeines, poliamides and others). They have small bulk weigth (0,005-0,2 kg/dm^3), good gases- and hydro-penetration through a material, the large adjustable specific surface. On a parameter specific biomass sorbtion various polymer carrier specimen surpassed keramzite considerably (8,5-22,5 against 4,4 mg/g accordingly).

For 8 month comparative study of biopurification with different sewage (chemical, petroleum pollution) in pilot biofilters clearing degree with polymer was comparable or better than with keramzit. Terms of a process saving on a mode of 90%-clearing was twice shorter. That, as a whole, confirms this materials perspectivity for use in biological processes of purifieng, including at airofilters and airotanks.

SLUDGE TREATMENT METHOD INCLUDING DUAL DIGESTION WITH INTENSIFICATION OF NITROGEN AND PHOSPHORUS BIOLOGICAL REMOVAL FROM WASTEWATER

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The key factor for the successful usage of phosphorus biological removal method is a high concentration of volatile fatty acids and readily oxidizable organic matter in WASTEWATER. Volatile fatty acids directly participate in the process of phosphorus biological removal being the main substrate for Acinetobacter microorganisms; under optimal conditions these microorganisms are capable of accumulating more phosphorus than needed for the increment. Readily oxidizable organic matter is the source of volatile fatty acids additional amount when this organic matter is hydrolyzed in the anaerobic zone; apart from that the organic matter increases the denitrification rate in the anoxic zone.

The increase of readily oxidizable organic matter concentration is widely practiced in different countries. This increase is achieved through anaerobic biohydrolysis of sludge and water in primary clarifies either via the increase of sludge detention time and recirculation or via the application of special facilities (acidificators). The introduction of hydrolysis at Northern Works in the Republic of South Africa resulted in considerable phosphorus removal improvement.

The further step concerning the development of the method for nitrogen and phosphorus combined biological removal is the understanding of hydrolysis as the first stage of sludge treatment.

The investigations carried out by our Institute revealed that technologically significant increase of sludge hydrolysis extent accompanied with the reactor temperature increase occurs at the temperature of 60-65°C. The hydrolysis should be performed at 20°C (i.e. without sludge heating) since the achievement of the given temperatures is not rational from the energetical point of view. The hydrolysis time for the settling fraction of suspended solids and the hydrolysis time for colloid organic matter differ considerable. The methanogens start to utilize the hydrolysis products of dissolved and colloid organic matter in case we increase the residence time up to the value required for the hydrolysis of the settling suspension. Thus the hydrolysis should be performed in two stages: the first one in acidificator (time determined by the optimum of the hydrolysis of dissolved and colloid organic matter) and the second one on the sludge removed from this facility (time determined by the optimum of sludge hydrolysis). The sludge directed to the hydrolyzer of the second stage should not be of concentration exceeding 10 g/l because of the need to remove hydrolysis products with liquid phase. The experiments conducted revealed that the second hydrolysis phase is well combined with the thickening allowing to get decantant water having concentration of up to 50 mg/l and readily oxidizable organic matter concentration of up to 1000 mg/l (COD).

The adoption of sludge hydrolysis process according to the proposed method in combination with UCT process provides the increase of phosphorus removal efficiency (for Kurjanovskaja Wastewater Treatment Plant low-concentrated wastewater) from 60-70% up to 90% with simultaneous reduction of the retention time.

The experiments revealed that the second digestion stage should be performed under psychrophilic conditions at the temperature of 20-25 C. In this case the energetical indices of the process are improved and the flocculating agent dosage required for dewatering is twice decreased. According to the experiments the flocculating agent dosage required is 1-1.5 kg/ 1 t of dry matter.

COMBINED TECHNOLOGY CLEANING SEWAGE

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In the NIKTI GH /Kiev/ are developed many versions technological scheme of deep cleaning sewage founded on the application of physicochemical methods.

Every composition of technological schemes includes three obliged bloc of cleaning structures.

The first bloc - it is bloc for mechanical cleaning. It includes the structures for filtration and removing heavy mineral admixtures.

The second bloc - it is bloc for reagent processing, it includes structures of reagent equipment and settling.

The third bloc - of additional dining, includes structures that work in the condition of filtration and/or of biooxydation of remaining microorganisms.

The set of structures cleaning complexes and their constructive special features determine depending on productivity, cleaning station, condition of placing and demand of quality cleaned sewage.

For the extraction gross dispersional admixtures developed filters of sewage that detain the admixtures with size ≥ 0,5 mm and grille rods type with mechanizided fining by gaps 16 mm.

For the disposal heavy mineral admixtures developed square caather of sand.

Developed also the typescale row of the structures bloc-modular construction of round and

square place on plan, destined for discharge heavy phase from processed by reagent sewage in condition of thin layer or volumetric settling. All structures equipped the mix, flakes form, autosystem of disposal slams and foreseed possibility for the work with different types of reagents and active silt.

For the additional fining sewage created the structures of different construction with sand, zeolite, volumetric plastic elements by plants manufacturing as bearer fastened microflora. Foreseed the possibility of recirculation of flow cleaning sewage.

Periodically regeneration loading material can be fulfill with mechanical and/or water-air system.

Recommended range of productivity developed complexes of structure 25-4200 m^3/day.

APPLICATION OF ELECTROCHEMICAL CONDITIONING IN TREATMENT OF WASTEWATER FROM HEAT POWER INDUSTRIES

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Improvement of industrial wastewater treatment technologies has been currently developed using the methods of electrochemical water treatment - diaphragm, membrane and diaphragm-free electrolysis, electrocoagulation and electrofloatation. These methods are effective in treatment of industrial wastewater containing various organic and inorganic compounds making these methods possible to be recommended for application at heat power industries which are one of pollution sources of the natural water bodies.

The most dangerous are the wastewater from chemical treatment, fuel oil, industrial facilities and clarified surplus water of hydraulic ash removal systems.

On the basis of laboratory and industrial tests and researches the electrochemical conditioning of wastewater from heat power industries was proposed to be used both independently and in combination with conventional wastewater treatment technologies. Electrochemical treatment technologies have been developed for clarified surplus wastewater of hydraulic ash removal systems, industrial wastewater and for wastewater from separate technological cycles.

Application of membrane electrolysis was found to be able to regulate pH of clarified wastewater of ash dumps up to specified values and considerably reduce the salt content.

Diaphragm-free electrochemical treatment tends to reduce concentration of oil products and chlorides both in combined industrial wastewater and in wastewaters from boiler rooms and

chemical water treatment system respectively. The technologies and devices are proposed for treatment of combined industrial wastewater with removal of metals in ion and organic element from as well as phenols.

Wastewater treatment schemes including electrochemical conditioning facilities have been developed for the conditions of purified water discharge into water bodies for use in an enclosed water cycle as well as for using the water treatment products in technological cycles of heat power plants.

The electrochemical wastewater treatment technologies, technological schemes and installations have been tested at experimental industrial facilities with surplus clarified water and at waste-storm water systems of steam power plants.

RE-EQUIPMENT OF THE BERLIN WATER TREATMENT WORKS FOR CONSEQUENT WASTE WATER TREATMENT AND BIOLOGICAL PROCESSING OF PHOSPHORUS AND NITROGEN AFTER THE EXAMPLE OF THE SCHOENERLINDE WATER TREATMENT WORKS

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The legal standards for waste water disposal at the water treatment works in West Berlin and East Berlin were unified in 1991 following the introduction of the European Council directives. Within the German current standards, it is necessary to observe the following minimum requirements for waste water disposal: P = 1 mg/l, NH4-N = 10 mg/l, inorg.N = 18 mg/l, CSB = 75 mg/l.

Technological and economic conclusions are made in respect of the re-equipment of the Schoenerlinde water treatment works to nitrification/denitrification and biological processing of phosphorus.

As regards the full biological treatment of waste water, a double or triple basin volume is needed for nitrification while a triple or quadruple basin volume is needed for integrated denitrification.

The available construction base is predominantly used for re-equipment of the existing biological stage of treatment for denitrification and biological processing of phosphorus.

In the reducing basin the content of dry substance increases by 4 g/l.

Because of deterioration of the sediment volume indicator (130 - 150 mg/l) the consequent treatment becomes the limited stage of the process.

BIOCHEMICAL TREATMENT OF ACTIVATED SLUDGE CONTAINING HEAVY METALS WITH OUTPUT OF COMMERCIAL PRODUCTS

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Investigations were carried out concerning to the elimination of heavy metals from activated sludge formed after biological treatment of municipal and industrial waste water.

It was established for the first time that the effective sorbtion of heavy metals from sludge takes place in the cultural liquid of special species of bacteria. Such a way of desorbtion is more efficient then other well known methods such as the elimination of metals under impact of acid.

During our process of biochemical treatment 70-90% of zinc, copper, manganese, cadmium, nickel and 50-70% of lead and chromium.

Sludge treatment by bacterial broth is carried out under pH=2.0. This acidity is mach less then under sludge treatment by inorganic acids (pH=0.5-1.0).

The technology of elimination of heavy metals includes also steps of sterilization and deodoration of activated sludge under practically total keeping its features as a fertilizer. The content of organic substances in the sludge is not changed practically after treatment and is equal about 30-40% of dry weight of the sludge. The lisis of saprophite and patogenic microorganisms and gelmints take place, which excludes the necessarity of heat rendering harmless of final product.

During above mentioned investigations we received the following results for lowering of heavy metals content in samples sludge:

zinc - from 2870 to 296 mg/kg,
copper - from 1497 to 252 mg/kg,
cadmium - from 40 to 12 mg/kg,
chromium - from 541 to 270 mg/kg,
manganese - from 1100 to 250 mg/kg,
lead - from 750 to 228 mg/kg.

We investigate the process of sedimentation of metals from their solutions, which were get after biochemical treatment of sludge. It is shown the principal possibility of fabrication of desorbed metals as commercial products, including selective precipitations of copper, zinc, nickel and chromium.

Experimental samples of surplus activated sludge were manufactured and passed for testing to the State Research Institute of Fertilizers and Agricultury Soil Problems.

The official sertification of this institute is received that activated sludge after desorbtion from it heavy metals is an efficient organic and mineral fertilizers. It is noted also, that the heavy metals content in the studied samples is 2-3 times less than allowed regulations, which are valid for fertilizers in European countries.

The proposed technology is wasteless and decides the questions of ecological security without any sewers and waste off-gases.

Engineering realization of this technology is developed and the volumes of main apparatus are calculated.

WATER AND WASTE WATER LOSSES IN PIPELINES

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The length of the waste water disposal system in Berlin is 8,518 km, including 3,565 km of contaminated water canals, 1,924 km of mixed water canals, and 3,029 km of rain water canals (as of 31.12.1995).

The first water works were put into operation in 1878. The network of contaminated and mixed water canals was treated and examined annually. In the examined canals of above 90 cm round section and above 100 cm high oval section the water management enterprise staff inspected and checked their state for the purpose of serviceability in accordance with the regulations of failure prevention and waste water disposal in the populated areas (waste water disposal works).

To get the full picture of the state of a waste water disposal system, water disposal structures inaccessible for inspection are checked by installed television cameras (6 pieces) and, nowadays, by imported equipment.

Water pressure in a waste water system of the water protection zone II is checked every 5 years.

Insulation of waste water canals in the water protection zone III is checked every 10 years.

Regular control is undertaken on the basis of the recommendations of the Water Engineering Association, namely, work bulletin A142 and also DIN 4033 (impermeability of pressureless water-ways).

The revealed unsealed places (for example, damaged pipe connections) are repaired by the Department of Canal Operation which has a I-Tryn car at its disposal.

Elimination of large damages is entrusted to the companies which concluded agreements with the Berlin Association of Water Management Enterprises.

It was proved that due to the preventive maintenance no contamination was observed when waste water is released.

&,640 km network of drinking water pipeline is 65 years in operation, and 66% of the network consist of gray cast iron. The number of cracks and damages in pipes of the main and public systems is approximately 1,300 per year.

We hope that this tendency rapidly developing nowadays will become a uniform process in the future due to the purpose-oriented change of critical areas.

The soil in Berlin does not provide for a long neglect of cracks in pipes and other heavy seals damages, and infiltrated water comes out to the surface. Therefore, water losses make up approximately 5%.

Systematic search for breaches by monitoring of pipelines and using correlators is carried out very economically (approximately 500 km per year) while periodic control of the equipment in accordance with the work bulletin DVGW W 390 has a higher value.

Thus, losses caused by the damaged pipes are minimized.

AERATION AND DRAINAGE DISTRIBUTION SYSTEMS

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The scientific and industrial firm "Ecopolymer" is specialising in development and commissioning aeration and drainage distribution systems made of tubular polyethylene elements.

"Ecopolymer" aerators are of tubular construction comprising the aerating element, the perforated carrier frame and sleeve couplings. The firm manufactures customized aerators, suitable in aerotanks of various constructions, diverse air distribution systems, running conditions, and the customer demands.

The aerator comprising the support pipe with regularly alternating longitudinal or spiral ribs and grooves, with the double-layer dispersing coating is the base model.

A model with specific structure of the underlayer and porous openings in the frame is intended for use in high-rate filters.

Intensive investigations performed by the scientific department of the "Ecopolymer" firm on hydraulic and mass transfer characteristics of aerators not only allowed to design an aerator approaching to optimal variant, but also to develop entire aeration systems with allowance for concrete parameters of aerotanks.

The aeration efficiency determination method is based on generally accepted procedures, and first of all on "Standard for the Measurement of Oxygen Transfer in Clean Water" (USA). At the air flow rate within 10÷30 $m^3/(m \cdot hr)$ the mass transfer coefficient (K_{la20}) amounted to 1.9 ÷ 4.6 hr^{-1}, standard oxygen transfer rate (SOTR) 50 ÷ 130 g/hr, standard oxygen transfer efficiency (SOTE) 5.4÷6.8 %, standard aeration efficiency (SAE) 4.4÷5.5 kg/kWh, head loss on aerators max. 20 cm. WC.

A method has been elaborated for modelling hydraulic characteristics of aerators with allowance for polydispersity of the dispersing coating layers and grooves and frame openings for air inflow.

"Ecopolymer" aerators mass transfer characteristics are on a par with the best aerators of the world leading firms, and this allows to use less air than the volumes necessary for bubble plates.

High oxidation power of the aerators has been verified by their operation at waste waters treatment stations. As a rule, when "Ecopolymer" aerators are installed at redesigned aeration systems, the air volume necessary for treatment is reduced up to 30 per cent. And, as a result, at some stations now operate two air blowers where previously three were used. And if the air blower switching off is considered not rational, its operation boosts oxygen content in the aerotank to 4.5÷5.5 mg/l, resulting in better nitrification, ammonium nitrogen removal up to 85÷97%, with smaller volumes of excessive sludge.

Combining the air duct and the dispersion unit, handy and simple connections of units allow to erect the aeration system in several days, and consequently to cut expenses of aerotanks re-equipment.

Products of "Ecopolymer" firm are protected by patents of Russia, Ukraine and USA. They are standardized and certified.

The scale of "Ecopolymer" products use is increasing from year to year, and in the first six months of 1996 it amounted to 5000 running metres per month. This was achieved as a result of operation experience gained at 120000 r.m. of our aerators installed at 72 stations in Russia, Ukraine, Moldova, SA, and also through new developments, techniques, inventions and know-how in computa-

tions, design and production. Viable design, simple erection and operation, high reliability, optimal combination of mass-transfer and hydrodynamical characteristics are the main factors leading to success of our products.

THE ADVANTAGES AND PERSPECTIVES OF POLYMER CONDITIONING OF WASTE WATERSLUDGE IN MOSCOW

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Moscow waste water plants generate daily about 30 000 m^3 of sludge. The main problem of the sludge disposal is the improvement of the dewatering characteristics by conditioning. Traditionally mineral chemicals such as lime and ferric chloride have been used. Before 1944 the dosages of 5-6% DS of ferric chloride and 15-20% DS of lime were used (the lower value for vacuum filters and the higher one for chamber filter presses).

Filter presses with a capacity of 3 kg/m^2/hour provided for 60-65% sludge moisture content (with the use of chemicals).

The disadvantages of this technology are high chemical consumption, difficulties in storage and handling of chemicals, high corrosion of the dewatering and pumping equipment, high concentration of dead matters in lime (up to 50% of the active part). Lately the cost of mineral chemicals has sharply increased resulting in higher operating costs of the dewatering process.

Since the problem of sludge disposal is very acute, the maximal possible dry solids concentration and minimal mineral concentration are very important. Reaching these goals will lower the utilisation costs and enlarge the range of techniques.

The development of applied organic chemistry in 80-ies resulted in a wide range of organic flocculants which could be used both for centrifuges, belt filter presses and chamber filter presses.

The process of polymer conditioning meets the present day sanitary demands since it is completely automated and does not induce ammonia emission into the atmosphere. Low concentrations of the working solution (about 1%) as well as the neutral origin of the solution do not cause any equipment corrosion. No dead matters are brought in.

Considering the present day prices for mineral chemicals and flocculants, the economic efficiency of introducing polymer sludge conditioning will exceed 300 000 roubles per 1 t of dry solids in raw sludge.

Beginning from 1984 Mosvodokanal have been investigating both on bench and industrial scale the introduction of the progressive technologies of sludge dewatering in Moscow. The preference is given to cationic high molecular flocculants produced by Stockhausen and Allied Colloids, Germany. These chemicals provide for intensive floc formation with free moisture separation at 3.5-3.7 kg/t dry solids dosages.

Pilot investigations carried out with Stockhausen equipment at Kuryanovo for flocculant blending and feeding confirmed the advantages of polimer conditioning and revealed the drawbacks of the existing mechanical dewatering equipment. The average dosage of 3.6-4.0 kg of flocculant per t dry solids the moisture content of sludge was 70%. The output of filter presses increased from 3 to 4.5 kg/m^2/h.

At present Mosvodokanal accepted polymer conditioning method of sludge dewatering. Considering the high demands to the quality of dewatered sludge and the operational experience of industrial and pilot installations for polymer sludge conditioning the problem of introducing advanced membrane chamber filter presses is to be solved.

Mosvodokanal in cooperation with Stockhausen Company, Germany, have established a number of joint ventures for manufacturing and distributing high molecular flocculants. The chemical plant in Perm has arranged the production and from 1997 they will produce annually 7 000 t of various flocculants.

To promote the technology of polymer sludge conditioning Mosvodokanal in cooperation with Stockhausen have established a Technical Centre which can assist industrial enterprises in Russia and CIS countries.

THE INFORMATION COMPUTER SYSTEM FOR THE STATE MONITORING OF THE GEOLOGICAL ENVIRONMENT IN APPLICATION TO THE CENTRAL AREA OF THE RUSSIAN FEDERATION'S EUROPEAN PART

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The information computer system for the State Monitoring of the Geological Environment (ICS SMGE) is under development on order of the State Geological Committee and makes a part of the State Digital Information Bank on Geology, providing the relevant sections of the bank with information. The software for the system is being worked out by Geosoft-Eastlink Joint Venture. The ICS comprises five subsystems, these are:

– REGION subsystem is dedicated to solving problems of the federal and also regional range as part of the federal one. The subsystem is based on GeoLink, a specialized geographic information system. The system is put into pilot operation by the SMGE Regional Division of the Central Region Geological Centre (CRGC).

– TERRITORY subsystem is oriented on tasks of the territorial level (territory of a subject of the Federation) and based on GWM, a processing computer system. It can be supplied with specialized software for simulation, including permanent models. The subsystem works in more than 40 SMGE Territorial Divisions, almost all Territorial Divisions of the Central Region Geological Centre run it.

– LICENCE subsystem was built for information support of mining activity licensing and it is linked to REGION and TERRITORY subsystems. Now it is tested on geological objects of the Central Region Geological Center.

– POLYGON subsystem is devoted for automatic data readout from sensors and remote devices, data transmission, processing and analysis of long observational series, and forecasting. The subsystem is developed for usage at the testing fields of the State Geological Committee and it enables automatic information readout from the devices of OTT MESSTECHNIK, the world leading manufacturer of the hydrometric measuring equipment.

– OBJECT subsystem is supposed to deal with geological monitoring of exploited mining objects, it is under development now.

The SMGE data bank is two-levelled. Territorial level data bases contain basic (primary) information, also here comes all representative information from OBJECT and POLYGON subsystems. Federal and regional level data bases contain generalized and folded information on corresponding territories.

Nowadays the Central Region Geological Centre and Geosoft-Eastlink started testing of combined operating of all ICS SMGE subsystems, including subsystem interconnection, data transmission from territorial divisions to the regional division and connection with the State Digital Information Bank on Geology.

WATER MANAGEMENT IN FAMILY ECOSYSTEM

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Water by its presence in the hydrosphere and through its role in the hydrological cycle is central to many environmental issues. The quantity and distribution of water determines types and diversity of the fauna and flora as well as the nature of people's activities.

Water is essential to life itself; for example the human body is 70 persent water. The rate of water consumption has increased as Society has developed. Industry consumes 21 persent of global water, which is an essential ingredient in the manufacturing processes of many products, for example, chemicals, paper and textiles. Water is used in energy production, as a source of energy in hydropower, and as a cooling agent for thermal and nuclear power stations. In some countries, rivers and canals are an important means of transport, especially for bulky, heavy products. Water is also a valued amenity as a visual asset and for leisure activities.

Water is used for a variety of domestic purposes, including personal hygiene and sanitation, cooking, washing clothes and for domestic cleaning. In the developed countries there is an increasingly high consumption of domestic water. The consumption of water for domestic purposes is also increas-

ing in developing countries as more house holds in urban areas are connected to a water supply, and in rural areas more wells and pumps are installed in the villages.

Home economics/human ecology is concerned with understanding how values guide individual actions and how the family as an unit manages household activities to contribute to a satisfying family lifestyle, Family characteristics are such as family income, child-rearing stages, nonworking and working homemaker, housing conditions and household appliances, beliefs and concerns of family or understanding of the world wide problem, of course especially relevant in understanding family water consumption patterns.

The objective of the study is to document the response of households as ecosystem in different socio-economic levels to the inadequate provision of water, sanitation and solid waste removal practices.

The essential component of the study is the design and implementation of a large household survey intended to elicit two types of information: household attitudes and practices about high-quality of water and water-saving practices.

METHODOLOGICAL ASPECTS OF THE PROBLEM OF INDUSTRIAL WASTE MATERIALS DEPOTS INFLUENCE ON GROUND AND SURFACE WATERS

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The interest toward the problems of water resources protection against exhaustion and pollution as well as toward water quality prediction, drastically increased during last decade because of the raise in water consumption by industry, agriculture and municipal economy.

Penetrating into water sources, pollution influences their sanitary state and decreases the amount of oxygen, dissolved into the water. This is why investigations of spatial and temporal distributions of admixtures are important for scientifically based estimations of water basins state and founding of pollution variation tendencies.

The major part of water pollution is due to the waste materials of production and consumption. On the territory of Russian Federation there is a lot of different waste material depots (e.g. "white seas", dumps etc.). Overwhelming majority of them gives rise to intensive pollution of ground and surface waters so being the toxically threat to human health and enviroment. In spite of the great danger of these depots, there is no methodology in Russia for estimations of pollution of environment parts (ground and surface waters, ground, atmosphere, byote) as well as for the consequences of toxically waste materials depots are very important. The methodology is based on the following reasons:

- the industrial waste materials depots can be taken as constant three-dimensional sources of poisoning;
- depots emit pollution by two streams (into air and into ground);
- pollution penetrates first into the air and ground and then into ground waters and surface waters;
- pollution penetrating into the atmosphere is partially caught by embedding surface, then penetrates into ground and water basins;
- the depots can be in the safe and emergency state;
- the danger estimation for a waste material depot is done using the experimental data on people health and environment conditions near the depot, or data calculated with the help of mathematical modeling;
- the final estimation of the danger of waste material depot is given according to the point scale;

The methodology have five main sections:

- investigation of depot conditions(including construction features of depot, composition and properties of waste materials) and nearest environment of the depot (demography, meteorology, geology, hydro-geology etc.);
- investigation of human health and environment parts near the depot;
- mathematical modeling of different scenarios for pollution of atmosphere, ground waters, surface waters and other environment parts;
- scaling of the danger of depot basing on the indexes of human health changes and the degree of pollution severity for different parts of environment;
- development of recommendations for decreasing the danger of depot.

Practical use of this methodology allows to develop the optimal recommendations(in the sense of expenditures and expecting effects) for exploiting of industry waste material depots giving also the possibility to find the optimal plan for saving water resources.

ABOUT THE APPLICATION OF PULSE - PERIODIC DISCHARGES WITH SMALL ENERGY PULSES IN THE SYSTEMS OF WATER TREATMENT

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The investigations results of the effect of pulse - periodic discharge with pulse energy of about 1J on water, polluted by microbes and chemical substances, including heavy metals salts, are presented in the report.

Cleaning effect of power discharges (electric - hydraulic shock) with the pulse energy of 1-10 kJ is well known and physical properties of such discharge have been studied in details. However practical realization of this effect in the form of the long-term and effectively operating facility has not been achieved yet. The realization of water stream hydrodynamics in the channel at the condition of periodically repeated electric-hydraulic shocks appears to be quite complicated. The solution of these problems has been found by the authors owing to the use of pulse-periodic discharge, generated in the chamber, through which the treated water flew. Pulse repetition rate was f=50-100 Hz. Specific effect energy was regulated by the water flow rate value.

The present paper contains some results of electrophysical characteristics investigations of pulse discharge in water with pulse energy of ~ 1J and the results of its application for polluted water treatment.

Experiments were carried out in the channels of different types, distinguishing in geometry and size. Electrodes geometry remained the same for all types: cathode was flat and anode was sharpened.

Pulse - periodical discharge with pulse energy of (0,5-1,0)J at different pulse repetition frequencies and at different water flow rates was used for the action on microbes and chemically contaminated water. Model solutions, containing **E.Colli** type bacteria, and the natural water of the Northern water - purification systems (St.Petersburg) were used in the experiments. Total microbes umber and phages content were controlled besides **E.Colli** when using natural water. It was established that microbes concentration is decreased for 6 orders and reaches the level less than 3 1/1 (colonies per liter) if the specific energy, induced into the water via the discharge, is about 3-5 J/cm^3.

Another experiments were carried out to determine the discharge action on water, containing pesticides. We managed to achieve deep purification at the energy levels of – 10 J/cm^3. In the process of water decontamination from microbes it was established that treated water, being stored for some period of time before water drain, may have positive effect on the cleaning process. Just for illustration with storage time increase from 15 to 30 minutes one can obtain the concentration magnitude less than 3 l/l specific energy decrease from 5 J/cm^3 up to 2 J/cm^3.

At present time the IPE RAS carries out investigations in the sphere of discharge application for water treatment together with SUI Company (USA). It was found that the use of discharge for sewage waters treatment significantly improves the mechanical drying quality: increases treated water transparency and saves the quantity of the used coagulant considerably (for 20-30%). Besides that, today the investigations of the discharge effect on water, containing salts of heavy metals, are also carried out. Preliminary experiment have shown, that the process of salts precipitation takes place after the discharge treatment. At the same time the rocess inductance time decreases with the increase of the effect energy.

WAYS OF INTENSIFICATION OF SEWERAGE TREATMENT PLANTS

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The period of 1960-1975 was a period of a rapid development of sewerage system. Sewerage treatment plants have been built and put into operation during this practically period in all large cities except Novosibirsk.

The absence of experience in designing, construction, adjustment and exploitation was the reason of many mistakes, some of them were repeated. For example in a constructional part of the project there were no strict requirements to a tolerance while constructing spillways in sludge tanks, aeration basins, silt compactors and other structures. At some built projects the real marks of spillways differed in 10-100 mm from designed, instead of 1-2 mm. As a rule all works in leveling the spillways were being made during the period of putting them into operation and were not always successful. The remained constructional defect reduced the

coefficient of utilization of projects volume and decreased the effectiveness of their work.

A very archaic scheme of air distribution through filtraiting plates was used in the initial period of sewerage development. Unfortunately, it is widely used nowadays. Large number of valves in spillway shafts made practically impossible to use them in cases of emergency, especially while a short stop of airfans. The sealing of plates in channels is very unreliable.

The practical exploitation showed, that in 1-2 years after putting aeration basins into operation breakers - the sign of the damage of joints integrity- appeared on the surface. And as a result the degree of destruction of organic matters decreases.

In the designs of 60-70 the installation of automatic test selectors were not envisaged. That's why the selection of average daily tests is made by operators. It is subjective. Laboratory data do not correspond to the real condition of on every project and the whole complex in general. It is difficult to systematize and use the accumulated data for the improvement of technological process.

The scarcity of control-measured instruments and their imperfection is the main drawback of home designs of the previous years.

Measuring of coming waste liquid, spent air, circulating active silt, the loading of sediment in methantanks were envisaged only the main lines. The distribution of streams between projects were made visually. As primary instrument diapfragm manometers were used. Their drawback was the often pollution of pulsed pipes. Because of this fact СУФ installed in surge tanks and silt compactors for controlling the sediment load operated for a short period of time. The question about the installation of instruments showing and registrating temperature, pH, dissolved oxygen and other in places of test selection was not discussed.

During the last five years the replacement of obsolete equipment has been made in some of the largest stations. of Siberia.

Arch grates (research institute KVOV) step grates (firm RIOTEK) system of air distribution through porous disc aerators of the firm "Greenfrog" and porous metal pipes, centrifuges and centripresses of the firm "Humbold" have been already tried out. Workshops dealing in putting of the finishing treatment of sewerage through granular filters and bioreactors are being built.

The later is equipped with parts which represent a framework with taut lavsan rag bolts. A workshop for dehydration of sediment with the installation of press filters of the finish firm in it, is being erected.

But at the same time at many treatment plants an absolute equipment is used. Especially it is difficult to serve grates of MT types, which are in such technical condition that detain only the main mass of wastes, while the rest penetrates sandtrap and primary sludge tanks making it difficult to unload sand by hydroelevators and damp sediment by plunger pumps. Because of this reason its volume increases twice against the designed one the load on methantanks, siltfields the workshop of the mechanical sediment dehydration increases, consumption of heat for heating sediment in methantanks increases too.

The analysis of the exploitation data of a number of stations showed that they all need either the increase of hydraulic load of the projects or the increase of the quality of discharge outlets in solids and BIQ, or the decrease of operational expenditures. Here is such a possibility to realize it a number of following measures should be taken.

1. Capital repair of all projects with the replacement of the existing system of air distribution into pore project and with bringing out all the spillways in the designed marks.

2. The replacement of the obsolete equipment especially grates, which allows to settle the complex of problems and made water treatment plants working according to an optimum schedule.

3. The installation of automatic test selectors and also instrument showing and registrating temperature, pH, dissolved oxygen.

4. The replacement of the control-measured instruments, technical wording out of settlements in measuring of discharges, air and sediment in places of their distribution between the projects.

5. Statistic processing of operational data and the usage of the results in management of technological process.

THE CHANGING EMPHASIS OF THE USE OF CONSTRUCTED REED BEDS FOR WASTEWATER TREATMENT IN THE UK

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The principal application of reed bed treatment in the UK in the 1980s was for secondary treament of sewage. These systems generally produsedeffluent of moderate quality which rarely compared to the standarts achieved by the conventional treatment processes.

Tertiary treament became the diminant application in the first part of the 1990s largely because of the adoption of such reed beds as a preferred process option by a major water and sewage treatment undertaker. This move was given by requirements to adopt reliable systems for small wastewater treat-

ment works in a climat of downward pressure on operating costs (Green and Upton, 1994). The development of gravel filled reed beds and their sucsessful application to tertiary treament lead to their use for the treatment of the storm water overflows on small works (Green and Martin, 1994; Green et al., 1995). By the end of november 1995, Severn Trent Water constructed reed beds in operation at 134 sites.

Whilst tertiary and stormwater treatment applications are expected to continue to dominate reed bed treament in the UK the interest has not stopped with removal of BOD5, suspended solids and ammoniacal nitrogen. Potential use of constructed reed beds in environmentally sensitive areas and their application by UK Water Companies in work outside the UK have brought about the renewed interest in removal of N and P and potentially pathogenic bacteria.

The paper rewiews and performance of reed beds in the UK both by the large water undertakers and in the less well documented usage by small enterpreneurs providing systems for nursing homes, hotels, caravan sites and individual dwellings. The application of reed bed treatment for typ run-off, leachates, industrial wastes and agricultural wastes has gained ground as interest has grown in environmentally friendly systems for dealing with such problrms.

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RUSSIAN-DANISH INDUSTRIAL-SCALE INVESTIGATIONS OF REMOVING NUTRIENTS FROM MUNICIPAL WASTEWATER AT KURYANOVO WASTEWATER PLANT

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Wastewater plants in Moscow were designed a few decades ago in full compliance with the environmental requirements of that time. Since then the understanding of the anthropogenic impact on the environment has changed with the subsequet toughening of the environmental legislation. Consequently, the technology used at Moscow wastewater plants does not ensure the effluent meeting the new standards for a number of parameters. The situation is complicated by the discharge of the effluent within the city area which is the first water user; consequently the concentration of the pollutants in the effluent should not exceed MPCs in the river water.

The most difficult value to reach is the maximum permissible ammonia nitrogen concentration which is actually 25-30 higher. Since the penalty for discharging ammonia nitrogen is very high, the wastewater plants find themselves in a difficult economical situation.

To solve the problem Mosvodokanal is investigating the world technologies of removing nutrients to be introduced at the wastewater plants. One of the technologies tested at Kuryanovo plant was designed by COWIconsult, Denmark. This technology provides for the removal of nitrogen by freely floating activated sludge in the process of nitrification-denitrification in one tank.

The main purpose of the experimental tests was to investigate the possibility of meeting Russian MPCs with minimal loss in the capacity of the existing facilities; and, in addition, to evaluate the operational parameters of the technology and the expediency of its introduction.

One of the lines of the pilot plant at Kuryanovo with a capacity 40 000 m^3/day including a horizontal primary settler, two-line aeration tank and a secondary settler was reconstructed for the purpose of investigating the COWIconsult technology.

According to the project the aeration tank was reconstructed into a bioreactor, whereas both settlers were not subject to any changes. In the aeration tank the partition between the lines and regenerating section was partially destroyed; the ceramic aerators were replaced by Passavant aerators; in addition, submersible Flygt mixers and control systems were installed.

The critical factor of nitrification-denitrification is maintaining the set concentration of dissolved oxygen and the ratio of ammonia nitrogen and nitrates with the help of continuous monitoring and computerized control. The design capacity of the experimental line was 30000 m^3/day.

The experimental results of the first year operation in 1995 at the loading of 30 000 - 35 000 m^3/day were as follows:

Table.

Waste water	SS	BOD5	COD	Nitrogen		Phosph. phosphate
				ammonia	nitrates	
raw	170.0	111.0	205.0	16.5	---	2.1
effluent	8.5	4.0	44.0	1.9	2.4	0.6
MPC	---	3.0	30.0	0,4	9.1	0.2

The above listed results show that despite very high efficiency of the experimental plant compared to the existing treatment facilities, the extremely stringent environmental standards for BOD, COD, ammonia nitrogen and phosphates were not met.

COMPLEX LOCAL SYSTEM OF THE CIRCULATING WATER SUPPLYING FOR CLEARING OIL BEARING INDUSTRIAL FLOWS

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Installation for clearing oil-bearing industrial flows for the systems of circulating water supply is intended for use in the local purification works of transport enterprises, centers of technical car service, clearing industrial flows from clay and sand, oil and their components soluble in water, fat pollutions, ions of heavy metals with organization of circulating water supply.

System allows to treat flows, containing up to 100 mg/l of petroleum products and up to 1500 mg/l of suspended matters. Effectiveness of clearing is more than 90%; up to 0,5 mg/l on petroleum products and up to 10 mg/l on suspended matters.

Daily output of installation - up to 50 m^3, area - 20 m^2, height of shop - 3 m, weight (net) - 1,1 ton. Power consumption - 3,7 kWt.

The following principal equipment forms the complete set of delivery: hydrocyclone-settler, system of filters, adsorber and hydraulic accumulator of pure water, set of pumps, control block.

Different unexpensive nature filter and sorbtion materials are proposed; effective technologies of their regeneration are worked out.

Complete set of equipment may be defined more exactly in connection with regular improvement of technologies and specific purpose of installation.

System provides the circulating water supply; replenishment of pure water doesn't exceed 10% of daily volume demand.

Pilot plants are working on several motor transport enterprises in Russia. Our installation may clear flows in the area of washing cars serving 100 units of motor transport during twenty-four hours.

THE ADVANCED TECHNOLOGY OF WASTE WATER PURIFICATION

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The unified technology of extracting heavy metals' ions, petroleum products and other organic or inorganic impurities from the industrial waste water has been developed. The technology is based on sorptional method of extracting harmful additions from water. Synthetic and natural materials enabling the deep purification of waste water are used as sorbents.

The greatest economic effect is achieved by application of sorbents in local purification plant of each concrete technological process. Such system provides the water closed-cycle system, as well as extraction of valuable components for reapplication in production.

Technology of purifying the chrome-containing waste water is really unique and makes possible to extract chrome without changing its valence condition. The technique of extracting 6-valence chrome from waste water became possible owing to the prolonged investigation in a sphere of syntheses of sorbents based on hydroxides of metals. Application of such sorbents allows to reduce chrome content to concentration about 0.001 mg/l.

The developed purification technologies may be used in galvanics, oil and gas processing, leather and fur enterprises.

The main advantages of the developed technologies are: development of water closed-cycle systems, reapplication of raw materials application of modular equipment.

SAPROPELS USAGE FOR VIRUSES REMOVAL FROM PARTIALLY PURIFIED WATER FLOWS

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Water is a favorable surrounding for spreading of viruses pathogenic for both animals and human beings. Nowadays well-known and widely used mechanical, physical-chemical and biological methods do not influence upon their quantity, The further water chlorinating does not guarantee their complete rendering harmless.

That is why it is well-timed to develop quite new methods and constructions based on specific features of viruses. The viruses ability to adsorb on a number of materials could be one of possible approaches to concentrate and remove them from water. Our previous investigations showed possible way of solving this problem by using sapropels for these purpose /F.I.Ignatovitch, A.M.Karabanov, 1995/. These natural mineral resources are formed at the bottom of fresh-water Lakes as the result of a slow decomposition without air of rotten vegetable and animal organisms. When adding dry sapropel to the liquid preliminary infected by grippe virus the decrease of remaining microorganisms quantities is observed after reagents mixing and sediment removal.

To increase the adsorbing capacity of sapropels they were processed by the solution made of equal parts of 2 per cent of hydrochloride acid and 10 per cent of sodium chloride during 24 hours. It allowed to remove completely viruses from the liquid even with less quantities of the sorbent under examination.

Our further investigations were aimed to study possibility of sapropels adsorb properties practical usage in water treatment from viruses. The experiments were made with running-water cylidrical reactor which was a glass column with 1-1,5 cm diameter and perforated plate soldered in lower narrowed part of it. According to the technology worked out the first grainy layer /sand or sand with gravel was put the bottom of it. then dry sapropel was inserted as a separate layer in proportion 1 g of sapropel to 100 ml of passing water.

The samples of water flows taken with a tampon of gauze after mechanical clearing /Methodological recommendations on sanitary virusological control of the environmental objects, Moscow, Ministry of Health of the USSR, 1982 - page 11/ were primarily treated and clarified by centrifuging. The existence of viruses was judged by the results of their antigens presence with the help of immune-fermenting analysis method /A.F.Frolov and co-authors, 1989/.

As it is known one can often find left viruses in water flows after mechanical treatment. After examining 40 samples we have found them in 6 cases /4 rotaviruses and 2 viruses of hepatitis A-type/. Additional clearing of the samples was done by pouring them through the experimental plant from top to bottom with the speed 3-5 ml per minute. After repeated examination viruses were not found.

Thus, the experiments showed the effectiveness and expediency of dry sapropel including into the technological schemes of drinking water and water flows treatment to clear it from viruses. They can be used in the first place in the purification works of small settlements and also for deep clearing of water flows running from, separate units such as infectious hospitals and etc.

THE TECHNOLOGY OF RECOVERY OF VALUABLE ELEMENTS AND PURIFICATION OF WASTE WATERS FROM METAL IONS USING BIOSORBENTS

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Biosorption is the process of binding of metals by living or dead biomass of microorganisms. Industrial biomass - wastes of medical and food industries - can be used for the production of biosorbents. The material for production of biosorbents is assigned to renewable resource. Distinguishing features of biosorbents are: selectivity, favorable kinetics, capacity for the recovery of metals from strongly diluted solutions and from the solutions with high salt background, and respectively low price compared with ion-exchange resins.

Biosorbents are capable for recovery of the following groups of elements from the solutions:

1. Radionuclides, Sorption capacity of biolsorbents reaches 200 mg/g biomass, It is significantly higher than that of ion-exchange resins and a number of inorganic sorbents that are traditionally used.

2. Noble metals. Biosorbents allow to recover these elements selectively from the solutions with high content of non-ferrous metals (more than 100g/l). Sorption capacity of biosorbents reaches 20-40 mg/g biomass.

3. Rare earth elements, Biosorbents can recover REE from acid solutions with high content of Al, Fe and others. Effective separation of REE is possible at the desorption stage. Sorption capacity of biosorbents reaches up to 40 mg/g biomass.

4. Rare metals (Mo, W) and also arsenicum which present in the solution in anionic form are validly recovered from acid solution on the background of high concentrations of non-ferrous metals. Sorption capacity of biosorbents is more than 200 mg/g biomass.

5. Non-ferrous metals (Cu, Cd, Zn, Cr, Hg). Sorption capacity of biosorbents reaches up to 35 mg/g biomass. Selective sorption of non-ferrous metals is possible on the background of high concentrations of Na, Ca, Mg.

Scale-up experiments carried out at the plants of Moscow region showed promise for using of biosorbents for the recovery of Mo, W, Ag, Au, Zn Cd, Cu in the complex schemes of processing and purification of industrial waste waters.

ENVIRONMENTAL AND ENERGY EFFICIENCY OF DIFFERENT SEWAGE TREATMENT PROCESSES

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The paper summarises the Scandinavian experience that chemical wastewater treatment gives "value for money" in the sense that such treatment gives a low construction volume per removed unit of Oxygen Consumption Potential (OCP) in the receiving water and a low energy consumption per unit of Oxygen Consumption Potential (OCP) removed.

The OCP evaluation takes into consideration both the primary oxygen consumption caused by organic matter and ammonium as well as the secondary oxygen consumption from degradation of algae resulting from the discharge of nutrient.

The paper demonstrates that in comparison to conventional biological activated sludge treatment (with presettling), chemical treatment plants (primary precipitation) are cheaper in terms of cost per unit of OCP removed and that they require less energy per unit of OCP removed.

Chemical treatment is considered to be the most suitable method when discharging municipal sewage to sensitive marine receiving waters and should be categorised as secondary treatment like biological treatment.

It is important when ecological aspects are considered, for instance in terms of energy consumption, that all elements that contribute to the total consumption of energy must be included. For instance, a compact treatment plant, like a chemical one, may require less energy for concrete, while it requires more energy for chemicals. The problem is evaluated in two different ways:

- An evaluation of energy consumption based on the major energy-associated elements: chemicals, air and biogas;
- An analysis of all ecological aspects based on a model for evaluating the ecological value of the products and processes.

WORKING OUT OF THE TECHNIC AND TECHNOLOGY OF INCREASING EFFICIENCY OF STAGNAUT AND STRATER OF WATER FROM THE OIL AND OILPRODUCTS

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Recently all countries face with the problem to decrease the ecological tension. It is particularly accrual for oil industry of the Azerbaijan republic where a great amount of stagnaut water with considerable components of oil products runs into the Caspian Sea. The chemical reagents especially coagulants and floculants are used with purpose of purification of the water.

But these chemical reagents and also the floculants mountains have a low efficacy of purification. With purpose of rise efficacy of purification the several experiments were carried out by us. We

worked at improvement and designs of floculant mountains.

In these experiments and investigations of the floculants "BO-75", "641" и "L-40/2" of the enterprise were used and the sulphuric acid aluminium as a coagulant was also used.

The result of the experiments showed that for the purification of the water from oil products the most effective floculants is the water-soluble (polymer) "L-40/2". It was found that the maximum close for the floculant is 20 mg/liter and for coagulant 50 mg/liter. The efficacy of purification from oil-products was 98,8%. The volume of the waste products from the oil industry didn't exceed 5% from previous volume.

It proves that the efficacy of solutions of polymer floculant "L" are practically surpass the efficacy of solutions of the floculant polymer.

These results were confirmed during the investigations, which were carried out on the floculant mountain.

APPLICATION OF THE ALUMOSILICATE COAGULANTS FOR PURIFICATION OF WASTE WATERS

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Decreasing of the quantity of waste waters is one of key problem in the environment protection. Flocculents, like aluminium sulphate (AS) or aluminium oxychloride are using in the technology of water purification and water treatment. However, noticeable raise of their cost demands to find other kinds of reagents. In this connection the alumosilicate coagulant (ASC), has been obtained from by-products of apatite production is very perspective.

A new coagulant has the following advantages: high flocculating capacity, low cost, universality in the application, since it can be used for removing both inorganic and organic compounds from aqueous media.

Comparative investigations of ASC and AS have been shown, that purification effectivity ASC higher then AS concerning of the technological water of the oil-refining plant. In particular, effectivity of ASC to remove of dispersed particles is equal 80 % (in case of AS - 40 %), of oily pollutions - 70 % instead of 35 % (for AS). In the same time the sedimentation time twice lesser for ASC then AS. In case of purification of meat-packing plant waste waters application of ASC allows decrease the quantities of dispersed particles and fats from 230 and 190 mg/l to 37 and 13 mg/l , correspondingly. The magnitude of chemical absorbency of oxygen decreasing from 670 to 150 mg/l, while application of AS permits reach only 380 mg/l. It was shown the high effectivity of purification of waste water of the lacquer-making plant (more then 98 %), textile factory, other wastes.

It was established, that ASC can be used for purification of the washing waters, which are obtained during lavage of soil, polluted by polychlorided biphenyl (PCB) or surfactants. The purification effectivity of soils more then 70 %, extraction of anionic surfactants and PCB are equal 60 and 87 %, correspondingly.

COLLECTION AND EVALUATION OF DATA FOR PLANNING OF SEWAGE TREATMENT PLANTS AND INFLUENCE ON THE COSTS

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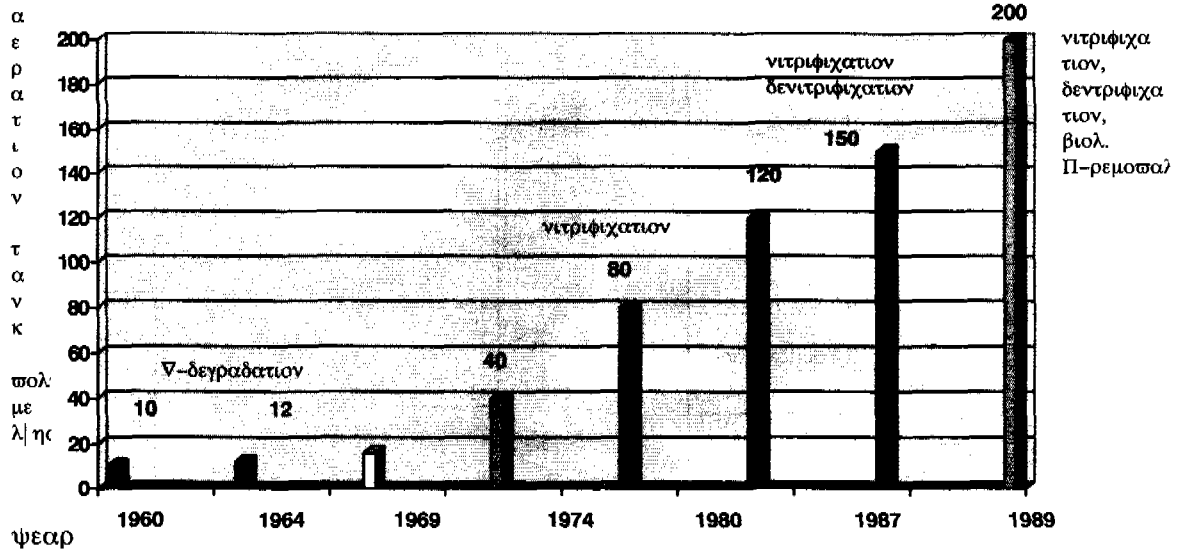
Planning for the construction or extension of a sewage treatment plant is based upon a compilation of the design approaches. In the field of municipal waste waters, an individual waste water characteristic has to be expected in each case, so that the establishment of design basics is of decisive importance, influencing all subsequent planning steps. Due to strong variations of charges shown by municipal waste water in the influent of a sewage treatment plant, exact knowledge of the physical, chemical, biological as well as process- engineering connections is required from the planning engineer.

The design approaches are determined by evaluation of existing data material and by collection of new data.

When evaluating existing data, attention has to be turned to the plausibility of the data. The collection of new data on the one hand is linked with the demands made on the purification capacity of the sewage treatment plant and thus influence the process engineering. On the other hand the scope of parameters to be determined depends on the input values required by the design procedure applied.

In order to determine number and way of sampling and to get transparency concerning the time for data collection, it is necessary to regard the different parameters which influence the calculation- and planning procedure. Here it turns out that the planning engineer has great influence on the final size and design of the sewage treatment plant by establishing and determining the design parameters.

Including results from pilot plants for sewage treatment provides valuable hints for design basics concerning waste water technology and process engineering as well as information for operation. In spite of initially higher expense for the establishment of basics, cost savings in planning and operation of the sewage treatment plant are to be expected later on. Concrete examples are presented in the lecture.



FiW Development of the specific tank volume 1995

IRRIGATION WATER DISPOSAL AND WAYS OF DRAINAGE WATER UTILIZATION

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The development of irrigation and solving the problem on elimination of its negative effects result in the formation of significant volumes of drainage water, reaching 40 % in a number of countries and more. Of 226 km^3 of water annually used for irrigation in the USA, 90 km^3/year are entered drainage network, and in China of 460 km^3 of water annually withdrawn for irrigation, 30-40 % are discharged from irrigated fields; in Russia of 15.4 km^3 of irrigation water the volume of drainage water makes up 9.9 km^3.

The efficient use of drainage flow as supplementary water resources, both in the initial form and after corresponding treatment, is the challenge.

The analysis of irrigation water disposal in Russia has shown that average drainage modulus makes up 0.088 l/ha, prevailing mineralization is 2-3 g/l, hydrochemical type of drainage water corresponds to natural regularities of development of halogeochemical process and depends on the intensity of artificial drainage of the area. The general purpose schematic map of chemical types of mineralized drainage waters for the irrigated zone of the European part of Russia is compiled based on the analysis of geochemical flows of groundwaters and data of the maps of salinization by chemicals, possible ways of drainage water utilization are envisaged.

Depending on the volume and quality of drainage waters, the following methods of their use are offered. With satisfactory quality: irrigation of agricultural crops, forest strips, pastures, recreation zones, etc.; establishment of water bodies for different purposes as esthetic elements of landscape; discharge into the rivers, lakes, seas. With unsatisfactory quality the implementation of measures on drainage water treatment, detoxication and desalinization is recommended.

Among the methods of improvement of drainage water quality recently there gain development biological methods as most accessible and ecologically sound. We have developed chemical methods of improvement of drainage water quality with application of synthetic ion exchange resins and natural sorbents. Designs are offered on desalinization of drainage waters is the technological plant directly at drainage system and selectively at each drain with the use of special patented filtering elements, installed in the drain outfall.

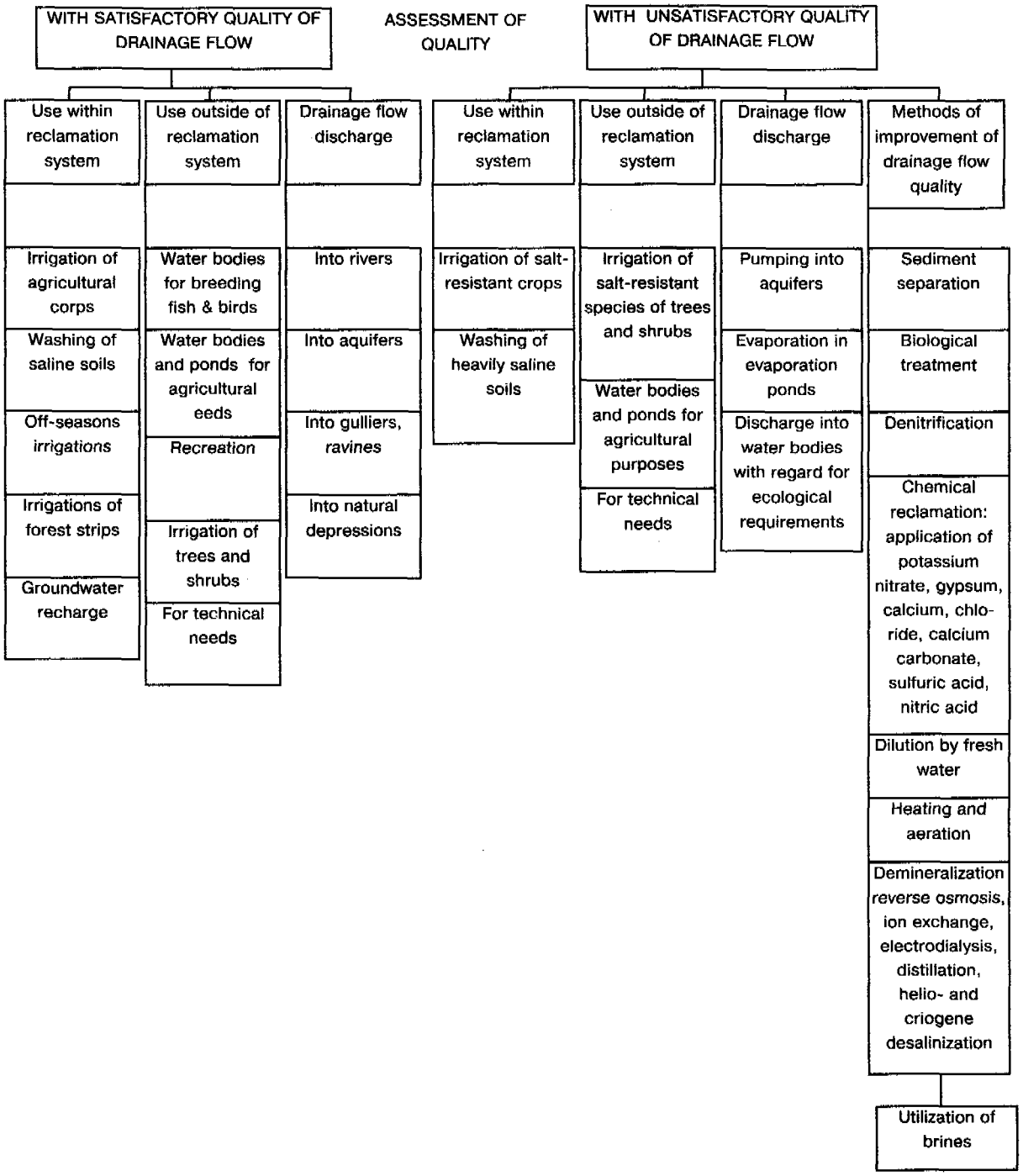

Fig.1. Basic methods of drainage water reuse

THE TECHNOLOGY AND EQUIPMENT FOR DEWATERING OF ORGANIC MATTER MAVING ORIGINAL MOISTURE CONTENT UP TO 98 % UNDER THE LOW TEMPERATURE AND VACUUM

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The unique technology and equipment for dewatering of organic matter having the high moisture content under the low temperature and vacuum are presented in this article.

The starting raw material:

Sewage sludge, primary sewage sludge and secondary sewage sluge, the poultry manure, cow manure and pig manure; vegetables, fruits and the feed mixtures; the medical agents (incl. blood preparation) having the moisture content up to 98 %.

The end product:

The dry organic matter having the moisture content up to 1%. The product is delivered in the form of granules, pellets or the powder with any mineral and biological additives having dimensions which complies with the international standards or is determined by the customer's request.

the dewatering of poultry manure, cow manure and pig manure makes the organic fertilizer of high quality; the dewatering of vegetables gives the possibility to obtain the foodstuff in vacuum package with the long serves life; the processing of the medicinal preparations (according to the proposed technology) ensures the long preservation of these preparations and the saving of positive properties in the starting raw material.

The water which is obtained under the processing is the end product and can be used after cooling both for the feeding of poultry and for the technical needs on the poultry farms and animal farms, where the equipment and technology for dewatering of organic matter under the low temperature and vacuum are used. It is obtained from 100 t of the liquid manure 17, 5 t of the dry granulated organic fertilizer, 82 t of heat water with the temperature 65°C and 0,5 t of gas exhaust which has the composition closed to the air.

The main characteristics of processing :

1. The absence of harmful gas exhaust in the atmosphere and sewages which are prohibitive from point of view of ecological requirements.
2. It is possible to use only electrical power.
3. The manufacturing equipment is erected according to module concept; the multiple and series connection of these modules allows to obtain necessary output of process and the given moisture of the end product.
4. The process is carried out under the temperature from 65°C to 130°C and the pressure from 10 to 100 tor.
5. The output of the equipment is from 15 to 150 t/day.
6. The specific power consumption is a maximum of 90 kw/t of the end product.
7. The condition for operation of equipment require the exist of closed heater room with indoor temperature from 18 to 20°C and normal humidity.

NON-REAGENT LOCAL COMPLEXES FOR INDUSTRIAL WASTE PURIFICATION

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The most advanced solution for the waste purification of industrial enterprises is the equipment with local small-size purification complexes that provide the waste purification and its return to the processing cycle; this equipment is designed for sections, departments, lines or separate assemblies, producing waste.

The application of the complex equipment is expedient because it uses the technology of electrochemical phase dispersive conversion of impurities and water, due to this process the contaminants coagulate on the hydroxide base, the processes of the impurities sorbing and the hard phase separation are being developed.

A number of standard sizes of the local electrotechnical complexes is developed by the specialists of the Scientific Research Institute "Strela". Individual items are made in small groups and delivered to regional customers.

Main characteristics are given in the table.

Table 1.

Equipment type	Maximum contaminant concentration, g/l	Purification efficiency, %	Maximum capacity, m^3/h	Overall dimensions, lxwxh	Weight, kg	Power supply	Specific energy consumption, kWh/m^3
1	2	3	4	5	6	7	8
ЛОК-0,1	3	99	0,200	0,6x0,8x1,7	160	built-in two channel rectifier 12 V 75 A	3
ЛОК-0,25	3	99	0,5	0,7x1,0x1,8	200	built-in two channel rectifier 12 V 100 A	3
ЛОК-0,8	1	99,5	0,8	0,6x1,2x1,0	170	ТЕР 2У-400А	2
ЛОК-1,5	0,1	99,9	3,0	1,5x1,5x4,5	1700	ТЕ-24-800 А и ТЕ-24-400	1,5
ЛОК-10	0,1	99,9	15	3,0x6,0x3,5	9000	ТЕ-24-1600 А и ТЕ-24-800 А	1,5

ЛОК-0,1 and ЛОК-0,25 are equipped with flotation plant operators for coagulation and the petroleum product removal.

ЛОК-0,8 provides the rinsing water purification in a number of rinse bathes of the galvanic line in continuous circulation made, it also can by used as a separate purification equipment.

Advantages of the electrochemical waste purification technology and local purification complexes in comparison with the reagent technology:

– requirements in areas in 2 times;

– reduction of cost price of water purification with water return to the processing cycle in 10 times;

– reagents isn't used;

– capital outlays in 2 times;

– some reduction of requirements in electric power;

– lower slurry volume and batter structure for treatment and reclamation;

– flexible adaptation to production conditions.

ЛОК plants have been acquired by twelve Russian enterprises.

MOSCOW WATERWORKS SLUDGE HANDLING

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At present Moscow waterworks produce over 5 million m^3 of sludge per year. The treatment of these sludges is performed at sludge lagoons and in sludge beds. Large amounts of sludges produced by Moscow waterworks and the imperfection of sludge treatment systems require more efficacious measures to solve the problem of sludge disposal.

MOSVODOKANALNIIPROJECT Moscow Institute for Water & Wastewater Research & Design carry out developments in search for most efficacious and economical methods for the solution of the above-mentioned problem.

The basic criterion for the selection of sludge handling processes is the ways (trends) of sludge disposal. The versatile analysis of various sludge disposal methods (concerning the waterworks of the City of Moscow) reeled the following most promising ways of sludge handling: sludge dumping and utilization in agriculture and in civil engineering. The analysis has also revealed the possibility of water works sludge disposal together with wastewater treatment plant sludge via waterworks sludge discharge into the sewerage network of Moscow. These methods are extremely efficacious and may be realized within short time. Waterworks sludge properties do not limit in any way the possibilities of its dumping. Moscow waterworks sludge relates to the 4th (the least harmful) category of hazardous industrial wastes; thus this sludge may be stored up at dumping sites without any ecological risk. Moscow waterworks sludge may be utilized in agriculture as a meliorant and as a recultivating soil. Waterworks sludge discharge into sewerage networks does not create any obstacles to normal operation of wastewater treatment plants or sewerage networks.

Combined waterworks sludge and wastewater treatment plant sludge disposal may be considered as a temporary measure for Moscow waterworks experiencing great problems concerning sludge disposal. It should be taken into account that waterworks sludge discharge increases the amount of sludge produced by wastewater treatment plants requiring increased volume of sludge treatment facilities located at these plants as well as additional dewatering capacities and sludge dumping sites. Waterworks sludge discharge into sewerage network will result in increased cost of pumping be sewage pumping stations. Waterworks sludge mixing with wastewater treatment plant sludge results in its contamination with heavy metals; this sludge may not be used in agriculture and may find only limited application in boilding materials manufacturing. Large-scale experiments on waterworks sludge application for ceramzite gravil production revealed that waterworks sludge addition saves up to 10 per cent of natural raw materials without any worsening of the produced material quality.

It should be noted that all the above-mentioned methods for waterworks sludge disposal require mechanical dewatering. The tests conducted showed that the sludge from the waterworks using the Moskve River as a water source are effectively dewatered by membrane chamber filter-presses and centrifuges (flocculating agents used as reagents but lime-free).

The application of flocculating agents for waterworks sludge conditioning results from considerable drawbacks peculiar to lime traditionally used for mechanical dewatering. Large dosages (over 300 kg/t of waterworks sludge dry matter) and active fraction low content in marketable product result in increase of wastewater content in dewatered sludge by 1.5 times, the increase of its volume and corresponding higher costs of its transportation. The flocculant dosage is about 4 kg/t of waterworks sludge dry matter, the water content in sludge dewatered with centrifuges is 73 per cent and 68 per cent when filter-presses are used. Low dosages of flocculating agent despite its high cost permit to lower the cost of waterworks sludge dewatering by 1.5-2 times (compared to lime application), to reduce the space for reagents storage and to lower the cost of transportation. It should be noted that the flocculant dosages used for waterworks sludge dewatering do not exceed the dosages used for wastewater treatment plant sludges.

OZONOFLOTATION OF ENVIRONMENTAL WATER AND WASTEWATER

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The method for ozonoflotation of various types of water in a facility of special design was developed by Mosvodokanalniiproject Institute. Ozone-containing gas is fed into the facility via porous dispersing devices and dispersed in the bulk of the water in the form of small bubbles. Ozone is dissolved in the water facilitating the processes of coagulation and flocculation of the pollutants. The aggregates produced are entrapped by the bubbles and transported to the surface of the flotator. The flotocondensate containing the largest amount of water pollutants is collected by the special device and removed from the facility. Apart from the flocculation the following processes take place during the ozonoflotation: water colour removal, improvement of water quality organoleptic indices and the lowering of water bacterial count.

The application of the process does not require the use of bulky treatment facilities. Operating ozone contact tanks may be converted into ozonoflotators with minimal capital expenditures. Ozonoflotation facilities may be operated at treatment plants of any output. The application of ozonoflotation at water treatment facilities provides the possibility to lower the dosages of coagulant and chlorine by several times, to decrease the amounts of filter wash water and to increase the duration of the filter-runs. The method is particularly efficacious for turbidity lowering, phytoplankton removal (especially during the periods of heavy florescence) as well as for the removal of bacterial contaminants, zooplankton and viruses. The application ofozonoflotation is expedient for posttreatment of biologically treated wastewater discharged into the water bodies of fish-breeding quality as well as for the tertiary treatment of wastewater reused for non-potable open systems of industrial water supply, for the replenishment of water bodies used for recreational purposes, for street-flushing and green plantations watering. Specific energy consumption for environmental waters treatment is 0.03-0.06 kWt-h\m^3; for wastewater tertiary treatment: 0.09-0.18 kWt-h\m^3. Duration of treatment is I5 minutes.

The comparative evaluation of ozonoflotation and ozonation during flood period and summer period (of the water from Moskva river water source) revealed the advantage of the proposed method concerning the lowering of the colour of the water being treated. The ozonoflotation effectiveness for the untreated water of identical quality was thrice as high as the ozonation effectiveness and was 80 per cent (ozone dosage = 0.5 mg/1 and bubbling rate =9 m^3/m^{2*} h). The colour removal was also more efficacious during the ozonoflotation process (one milligram of absorbed ozone corresponded to colour removal by 18 degrees). The oxidizability of ozonoflotated water was 1-1.5 times lower than after ozonation (the ozone dosage was identical).

The examination of the process of ozonoflotation of biologically treated wastewater at Kurjanovskaja

Wastewater Treatment Plant of the City of Moscow revealed that for the ozone dosage over 15 mg/l the coliform index of treated water did not exceed 1000 kl/l and the suspended solids content was 3 mg/l. The treated water was non-toxic for worm-blooded animals when it penetrated into their organisms either orally or through inhalation or through the skin.

THE PROBLEMS OF PURIFICATION AND UTILIZATION OF DRAINAGE WATER

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The territory of irrigate lands in Turkmenistan increased from 434 in 1960 to 1453x10^3 ha in 1992. The drainage water (DW) diversion increased from 0.1 to 6.6 km^3/y during that years. From the total value of DW 3.6 km^3 returned into the rivers. The return water obviously affects the water quality in the rivers. In the lover reaches of Amudarya, salinity concentration levels exceed 1.5-2.5 g/l. In some period 25-30% to the flow consists of DW. The river water is containing in addition to salts, chemical fertilizers, pesticides, oil products and heave metals. The river water not only doesn't meet the required quality standards for drinking water, but it can't even be used for irrigation.

Annual DW discharge of 3.0 km^3 into desert resulted in raising the ground water table, resulting in waterlogging, and salinization of the ground surface, It polluted ground water on the gangland territory over 700x10^3 ha. To protect the environment against pollution it necessary to purity this DW to render it harmless.

About 2.0 km^3 from the total value of DW has salinity 2.5-5.0 g/l and may be used for irrigation. The short timely experiments of irrigation with that, of sort of DW had been carried out before and harvest proved to be 15-20% less then usually. Nevertheless after some time the crops capacity were reducing and now there is no certain recommendation about harmless bound of DW mineralization.

The only protecting measure for making harmless DW in Turkmenistan is diversion it out of the way from irrigated area by main drain to a few low situated before hand build, serving several regions collectors. The system will colled all DW from irrigated lands of the Lebap, Mary, Akhal and discharge in into the Kara-Shor Depression through a 765 km long canal. This polluting agents contained in DW are not abated, but a transported and redeposited downstream.

There were proposed some another technical design water and environmental protection measures more radical and more progressive for arid zone: I. Diversion DW to evaporation ponds (EP); II. Desalination of DW at closed desalination plants (DP) with discharge flow into EP; III. Desalination DW at complex demineralizing plants (CDP) including water preparation, desalination, concentration of brine with further extraction of trade chemical products and burial of the residue.

Since it is known, EP are already functioning for rendering harmless waste flows from some factories and power stations. Three desalination technologies have been considered into II-IV: distillation (D), electrodialyses (ED) and reverse osmoses (RO). The salinity rate DW for D technology is within the range of 2-35 g/l, and for ED and RO technologies - 2-10 g/l. Composed the map of water supply system and water protection of Turkmenistan, where points of desirable situation of CDP are shown.

1.85 km^3 of total value DW is most dangerous for environment and is to be desalinated. It is necessary for desalination such value of DW 3,67x10^9 rubbles of capital investment (in price 1984), 1,235 MW electric power, and 23x10^6 tons of equivalent fuel, The result will be 1.73 km^3 of fresh water and 16.2x10^6 tons of chemical.

If total DW flow would worked over it is should be spend 8.25 10^9 rubles capital investment (in price 1984), 2,520 MW of electric power and 43.3x10^6 tons equivalent fuel. Young state isn't able carry out the program in its full value. It may be carried out gradually by material and technical help of worlds associations.

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BIOPURIFICATION OF WASTES FROM OIL PRODUCTS AND RADIONUCLIDES

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Within the activities under the Project № 119-95 characterization, isolation and tests of petroleum derivative-degrading strains are planned to be carried out. We have chosen the atomic power station located within the Zaporozhe region as an object of particular environmental concern. We have also tried test the results from our researches industrial field.

The main problems related to the environmental situation at the station are availability of reactor

waste waters polluted with radionuclides, such as ^{137}Cs and ^{60}Co as well as with oil products resulted from the operation of transfer pumps.

As a means to remove radioactive pollutants we have tested at the station the sorbent "Fegel" developed by the Russian-Canadian Joint venture "Kompomet-Kentek". The sorbent is a by-product which has been obtained in the process of thermal treatment of wood chip impregnated with solution based on ferrocyanides.

Since the discharged water contains the complex of radionuclides and oil products, as a carrier for destructive microorganisms we have used the sorbent "Fegel" with immobilized, according to specific techniques, association of microorganisms supplemented with stabilizers. In addition, we have used microorganisms of genera such as Pseudomonas, Acinetobacter, Mycobacterium as working strains. As a result of combined application of Fegel and specifically isolated bacterial cultures of microorganisms, there has been developed the preparation "Fegel-Bio", the product of new generation.

This product due to its specific features is able to adsorb oil-products and radionuclides by its surface.

The preparation "Fegel-Bio" has been tested in three steps.

The first step involved the application of the biopreparation as sorbent to absorb oil-products from hard surfaces. For this purpose the preparation was distributed over the greased surface, kept for 1-2 minutes and then skimmed from the surface. The analysis of the surface was carried out according to the conventional sample print method. Absorption of oil products from the surface has been found to be 80-97% depending on the type of the surface. The ability of Fegel-Bio to absorb oil has been estimated to be 4.8-5.0 g/g.

The second step was related to experimental use of the "Fegel-Bio" preparation in the water of cooling systems in the reactor, which contained oil products at concentrations of 5.2 mg/l and 330 mg/l. Pilot-scale studies were performed by using a specially designed reactor of capacity of 2 cubic meters. The quantitative analysis of oil products was made prior and after the treatment by "Fegel-Bio". The results obtained have indicated that the sorbent "Fegel-Bio" is able to absorb successfully (up to 93-98%) oil pollutants available both at low (5.2 mg/l) and high (330 mg/l) concentrations. Microbiological research has revealed that of all 8 strains introduced in the bioreactor containing "Fegel-Bio", the five strains were succeeded in growth, the amount of them was about 80% of total biomass of bicrobiocenosis.

To confirm the ability of "Fegel-Bio" to retain its main property to absorb radionuclides after immobilization on it of cultures of microorganisms degrading oil-products we have tested the preparation in purification of water containing ^{137}Cs. On passing of the water through a specially-designed column contalning "Fegel-Bio", it was noted that the specific activity of ^{137}Cs $9.7 \cdot 10^{-9}$Ci/l ten-folds reduced at the column's exit and was found to be $9.7 \cdot 10^{-10}$Ci/l.

Based on data from the preliminary trials the activities within the third step were aimed at application of the main destructive cultures under laboratory conditions by using power station waste waters containing petroleum derivatives at different concentrations. The trials were carried out by using high-loaded trickling filter according to the running flow technique.

Pea gravel as being less expensive product was used as a carrier for biofilm in the bulk volume of the biofilter. For adsorption of radionuclides, there was fitted a special cartridge containing the "Fegel-Bio" preparation. Analysis of waste water which passed through the biofilter confirmed high purification of water. Degradation was estimated to by 98-99% as compared to the initial concentration of petroleum derivatives of 0.1-0.5 mg/l.

ECOLOGY AND ENERGY ECONOMY IN CHEMICAL, PETROLEUM PROCESSING AND OTHER INDUSTRIES

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In connection with the conversion of enterprises of military industrial complex possessing high technologies and highly qualified personnel the real necessety of using the technical and creative potential of these enterprises for output of the hydroeconomic equipment has arisen.

LENNIICHIMMASH Co. offers a number of original designes in the indicated field.

LENNIICHIMMASH Co. developes and brings the heat exchange air cooling apparatus (for example compressor plants instead of water cooling) into commercial practice using of which is tightly connected with solving the problem of shortening the consumption of water for technological needs and the decrease of the environment contamination, specifically water bassins.

The application of air cooling apparatus gives the following advantages:

- reduction of the cooling water consumption up to 80 %;
- reduction of capital and operating costs because the necessety of building the water intake constructions, cooling towers, water works, water purifying constructions and piping systems of grat extent is dropped off, the heat exchange equipment maintenance is shortened;

- universality - possibility of the technological plants building out of connection with water sources and at the same time of the choice of construction areas as much as possible close to starting material sources or regions of the ready product use;

- raised ecological purity permitting to avoid contamination of rivers and reservoirs and in particular to exclude ingress of clorides, acids, phenoles, sulphides into water and at the same time to exclude the possibility of raising the temperature in reservoirs and as a consequence reducing the oxygen content of water, its "blooming", reducing the viability of flora and fauna.

The method not having world analogs and the standart size series of installations for dehydration of the natural and waste water sediments based on freezing with subsequent defrosting the sediment in which the colloidal system not permitting to separate the sediment is decomposed under the action of intercrystalline pressure is developed by LENNIICHIMMASH Co. The method is introduced at Saratov water supply station. That allowed to avoid the disposal of contaminated sediments into Volga, that are dispatched to the brickyard after the proper utilisation.

For unloading high-viscosity fluids from apparatus and collectors and transportation along the pipelines, for example thickened suspended matters of purifying constructions, LENNIICHIMMASH Co. with using know-how has developed and introduced in Russia and abroad the devices of pump-rotory type with possibility of control of the rotors rotating speed in the range 20-80 rpm with providing the capacity up to 50-70 cub.m/h. There are the heat exchange jackets in the devices at pumping over the solidifying fluids.

For solving the domestic and industrial food waste utilisation problem and conversion them into high-energy feeds for large commercial swine-breeding complexes, fur farms, poultry plants the reliable and convenient to service special digesting autoclaves 6.3 cub.m in volume were developed by LENNIICHIMMASH Co. and successfully introduced in Leningrad region.

Utilisation of toxic gases, dust-gas waste, for example in the splint-slab plates production, may be carried out by means of the fuel gas generator used in the technological units of heating, drying and roasting in chemical, petrochemical, food and other industries and agriculture, for example for drying feeds, grasses, grain, receiving the vitamin grassy flour etc., that is designed and manufactured by LENNIICHIMMASH Co.

For producing ecologically pure compressed gases and air not contaminated by lubricating oil the high-reliable compressors without lubrication of cylinders and stuffing boxes are designed by LENNIICHIMMASH Co.

LENNIICHIMMASH Co. carries out the complete complex of works for studying, designing, manufacturing, putting in operation and servicing and at the same time for determinating the residual work ressource of the offered apparatus and plants.

THE EFFECTIVE SEWAGE PURIFICATION PROCESS FOR AGRO-INDUSTRIAL COMPLEX FACTORIES OF THE REPUBLIC OF TATARSTAN

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The specific character of Tatarstan country-side agro-industrial complex factories (meat-packing plants, dairy and creamery) consists in separate territory location, small output and, accordingly, small daily sewage amount. These factories sewage represent highly concentrated colloidal dispersions of various qualitative soiling composition. The great content of suspended particles, fats, high index of biological oxygen intake (BOI) and chemical oxygen intake (COI) makes these sewage ecologically dangerous especially for the active sludge vitality in the case of sewage discharge to waste or to the biological purification sewage works (BSW).

It is necessary to supply each factory with the local new-tupe sewage works (LSW) for the purpose of BSW work efficiency increasing and the load reducing.

At present the most typical process of industrial sewage purification which is used on the majority of factories is the gravitative sedimentation. The efficiency of purification is only 25-30% because of these sewage aggregative and sedimentative stability. The research and production firm "TOROS Ltd" works mainly in the direction of carrying out the developments in sphere of agroindustrial complex factories sewage purification. The firm has a considerable experience in the local sewage purification and settling utilization of meat-packing plants, dairy and creamery factories. This allows finding the most effective, not expensive purification process during the preliminary analysis and costing the project the operating local sewage words (LSW) reconstructing, modernizing and using.

Working out s sewage purification process takes into account the production character, an output, soiling qualitative and quantitative composition, smoothness of work, the sewage discharge to waste water disposal system and the area under the equipment.

She rectant method of sewage purification is especially suitable for country-side factories because of it's availability, simplicity and reliability in service. It's application does not leads to expensive reconstruction of available local purification words,

This method shows a high degree of purification: 90-95% for the suspended particles, 85-90% for fats, BOI - 50-60%.

Universal modular apparatus based on the watersoluble floculant and coagulant reactant purification process has been developed by the firm "TOROS Ltd" for the mini-dairy and meat-packing factories, The alkaline industrial waste has been investigated and suggested as an effective coagulable and new tralizing reactant for sewage purification parallel with the traditional coagulants-aluminium and ferric salts, This reactant of sewage treatment was shown to reduce the amount of fats in the clarified waters and to increase the ferment sludge activity at the discharge of the clarified waters into the BSW. The firm "TOROS Ltd" hold a patent on this reactant (pat. N 2042642). The latter is hydienically certified (N 01-02-2081. 28.09.95) and permitted to application for industrial waste waters purification.

The processes developed by the firm "TOROS Ltd" have been brought into commercial practice and are used for dairy and meat-packing plants sewage purification in the Republic of Tatarstan.

THE EFFICIENCY OF WASTE WATER TREATMENT AT MOSCOW PLANTS: RUSSIAN AND INTERNATIONAL EVALUATION CRITERIA

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Moscow waste water plants have been designed and built following the traditional full biological treatment technology. The SS and BOD of the effluent are lower compared to the European standards. However, the effluent quality does not meet the demands of the newly adopted in Russia sanitary and environmental standards.

Table

Index	Unit	Waste Water Plants				Standards	
		KWWT	LWWT	ZWWT	Perspective	Russia	EEC
Capacity	mln m^3/day	3,625	2,5	0,09	---	---	---
SS	mg/l	12,0	8,3	4,4	8,0	5	35
BOD5	mg/l	9.0	4.8	2.7	7.0	3 (BOD total)	25
Ammonia nitrogen	mg/l	9.5	6.6	1.2	1.5	0.4	10
Nitrate nitrogen	mg/l	1.7	11.9	9.9	8.0	9.1	10 (total N)
Phosphates (as P)	mg/l	1.2	1.8	2.1	1.0	0.2	1.0 (total P)

KWWT - Kuryanovo waste water plant. LWWT - Lyubersty waste water plant. ZWWT - Zelenograd waste water plant.

The evaluation of the receiving water bodies in Moscow Area showed significant discrepancy of the effluent quality and existing norms enlisted in the "Rules of Surface Water Protection From Pollution".

The main difference between the Russian and European standards is that in case the effluent is discharged within the city boundaries it is equated to the natural water according to the Russian environmental legislation.

The Russian effluent quality standards are more stringent compared to technically available methods of waste water treatment both in Russia and in other countries. According to the opinion of foreign experts the Russian standards are not economically feasible. The existing demands to any type of water bodies results in the increasing treatment costs. Their environmental value is doubtful since the expenditures for building huge plants for advance treatment may be significantly higher compared to the environmental effect they may provide.

We think it is necessary to discuss the expediency of the stringent standards to be applied to the effluent discharged into the water bodies which are not actually used for fish farming.

We need to develop standards which step-by-step limit the effluent quality, i.e. feasible both from economic and environmental aspects. This task becomes most important nowadays after Russia has joined the European Council.

However, Moscow is characterised by the combination of low flow of the water receiving bodies and high effluent flow rate. Thus, higher quality of waste water treatment compared to the European standards becomes necessary. First of all, it is re-

lated to nutrients. The balance analysis of the incoming components in the Moskva River showed that the effluent does not increase suspended solids, mineral substances or heavy metals in the river flow downstream of the discharge point; however the effluent is responsible for 94% of the total nitrogen and 78% of total pollutants in the river. It is explained by the lack of nutrients removal in the treatment process since at the stage of designing the nutrients were not subject to any limits in the standards.

In this connection the step-by step introduction of nutrients removal keeping the high level of suspended solids and BOD removal at the Moscow waste water plants is a first priority task. The new waste water plants should be designed following the advanced technologies.

REMOVAL OF PESTICIDES, HEAVY METALS, CHEMICALS FROM DRAINAGE FLOW USING DETACHABLE FILTERS

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An alternative of a detachable multi-stage filtering element consisting of several adsorbents is suggested. A procedure has been developed. The results of laboratory tests for the efficiency of purifying mixtures, which are involved in the detachable filtering elements, in the process of removal of pesticides and heavy metals from drainage flow are presented. The filter in question permits effective purification of drainage flow depending on the initial water quality. The studies have revealed the efficiency of using granulated sapropel and ameliorative agent "SORBEX" as sorbents.

During filtration through these sorbents the drainage water becomes practically free of organochloric pesticides; the content of lead, copper, and zinc noticeably drops; the ion relationship improves.

WASTE WATER TREATMENT BY USE OF A MULTIPURPOSE ION EXCHANGE SYSTEM

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There are two main circumstances when a multipurpose waste water treatment is necessary, namely: a water treatment system processes the waste waters of several process plants which are sequentially put out of operation for different reasons (maintenance, repairs, technical failures, improvements, etc.) or the water treatment system processes the waste water of a multipurpose process plant.

In both cases the quality and quantity of the waste waters sequentially vary.

The paper deals with the description of a mathematical model for the optimisation of the material balance of a multipurpose water treatment system as a basis for the system optimum design.

The model is based on the following main concepts:

- A multipurpose water treatment system is a system performing sequentially, during certain time periods, the purposes of several singlepurpose systems which are compatible with the manufacture and operation of the equipment;
- The investment costs of the multipurpose system must be lesser than the total costs of the respective single purpose systems;
- The model is developed by a system approach considering for simplification two interdependent main subsystems, namely an ion exchange subsystem and an ion- exchanger regeneration one. The first subsystem performs the minimisation of the pollutants quantity according to the respective utilisation and environment protection requirements of the processed waste water. The second subsystem performs the regeneration of the ion-exchangers in order to be recycled to the first subsystem;
- The capacity of the subsystem is expressed by the total quantity of the components (species) which enters in the subsystem;
- The optimisation criterion takes into consideration the costs of the ion-exchangers and operation of the subsystems (including utilities, maintenance, repairs, salaries of the staff, depreciation of the equipment, etc.).

The objective function of the model expresses the minimum costs of the ion-exchangers and operation of the subsystems.

The constraints are the material balances of each component and constituent singlepurpose subsystems and relations expressing the depen-

dence of the multipurpose subsystem capacity on the respective single purpose subsystems capacities.

The variables are the component quantities which enter in the subsystem or leave it and capacities of the single- and multipurpose subsystems.

The constants are the transformation and separation fractions of the components in the subsystems, at one pass, available quantities of polluted waste waters or required quantities of pollutants in the processed waste waters. The transformation and separation fractions are determined on the basis of the ion-exchanger qualities.

The model is non-linear and may be solved by using algorithms based on the decomposition of the non-linear problem in several linear problems which may be sequentially computed by an algorithm Simplex.

The model suggested in the paper is a development of a model previously published [1] and has the advantages of a minimum required number of basic design data, flexibility of analysing a large number of technical and economical alternatives and a high accuracy of the results.

At the present time the model is in the state of testing for some multipurpose waste water treatment systems using Dow Chemical ion-exchangers.

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THE ALGAIC INDUSTRIAL SEWAGE & SOME WAYS OF ITS PURIFICATION RESEARCH

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Jellyformes & thickeners which are manufactured around the world are of high demand products received form the sea (algae& grass). Yet one needs a lot of water to manufacture them. F.e. to have a kg of agaroid, of furcellaran, of pectin manufactured it is necessary to use 0.44 m^3 of water & 0.83 m^3 of alginat. Above, the technological process of their manufacturing includes a hydrolysis stage. Therefore the forming sewage of wastewater (WW) is vast in capacity, its pollution grade is high due to the research results. The forming WW contains a great number of suspended, organic & other substances. Composition & capacity of the pollution depends on nature & grade of the adopted technology, on the stage of the technological process, that's on the nature & grade of force upon an initial raw material. Thus, in the process of agaroid production the washing shop WW forms the larger capacity of locally WW whereas its part in all the technological WW gets up to 87.6%. The general agaroid production flow contains 1039 mg/l of suspended substances, whereas the chemical oxygen consumption (COC) equals to 1538 mgO_2/l. The locally forming WW deffers due to its capacity & pollution stage. As an example might be taken a washing shop WW which consists of 1241 mg/l of suspended substances & its COC equals to 1122 mgO_2/l. The WW differs not only due to the integral indices of pollution stage, but also due to its forming substances. According to the abovesaid, the algaic industrial WW can not be neither reused nor simply thrown to a water reservoir or to a drain canal without being first purificated.

By choosing the sewage WW optimum purification way it has been investigated both a flow & a locally forming WW. Under the research were also the usage of various mechanical, physical & chemical, as well as pure chemical ways and their combinations of purification. According to the reached purification results such ways sere determined: an expediency way of setting-down using; a centrifuging way; and electrocoagulation way while using various kinds of electrodes; a way of filtering while applying zeolites; and absorption way while using an activated coal; an ultra-filtration way while using the UPM-P deaphrams; a coagulation way; an ultra-filtering way along with an absorption with help of an activated coal & zeolites; an oxigening way along with a coagulation & further filtering through a granulated filter etc.

As it's shown in the work (1) based upon the results of an agaroid jellyformer manufacturing out of phillophora, and agara - out of gracilaria, a furcellaran - out of the furcellaria & phillophora mixture as well as a pectin thickener - out of algal, the suspended substances could be taken away by centrifuging & electrocoagulating methods up to 80.0-98.9%. Yet only the coagulation way with the help of aluminum electrodes could ensure a sufficient COC lowering (up to 80%); the ultra-filtration way coupled with the activated coal adsorbing one (in this case the COC was lowered up to 85-96%); the oxidation way along with water chlorading & further coagulating with an aluminum sulphate & sand filtration (the purification grade due to the COC was raised up to 91.4-96.7%). It's necessary to point out that live tests of the WW purification by the centrifuging way along with a further electrocoagulating that was actually undertaken at an acting factory delt with an agaroid manufacturing out of phillophora, have completely certified the abovestated results. Due to them, the in such a way purificated WW could not only be dumped to the drain system to be biopurificated there, but even be industrially re-used (without the desired product's quality lowering), thus insuring a considerable water usage cutting down.

Aiming to a simple & effective WW purification way bring a possibility to improve the algaic industry ecological situation, to cut down water consumption

as well as to deeper investigate the technological processes improvement, to form a correct estimate due to a desired product's quality & quantity. It also could lead to the clean water irretrievable consumption cutting down, to the lower grade of the WW pollution & thus to the possibility to purify & re-use it.

Much gratitude of the authors to the professor's assistants I.A.Voloschenko, S.G.Dyrikov, S.V.Krasilnikova & M.P Platonov for their interest & cooperation.

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ORGANOSILICON BIO-STIMULANT FOR SEWAGE DECONTAMINATION

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In order to promote domestic, industrial and mixed sewage decontamination a new environmentally safe bio-stimulant consisting of organosilicon compound of silazane structure (D-TBA) was developed.

The bio-stimulant is a low-volatile, labile translucent fluid (colorless or light-amber colored), its boiling point is 30°C at atmospheric pressure, the stimulant dissolves in organic solvents, water solubility is 50 mg/L; it retains its activity in aqueous solution during 24 hours then it dissociates without no toxic product formation.

On the basis of medical and hygienic investigation it was found that "D-TBA" does not penetrate undamaged skin and mucous membrane, does not possess locally-irritating and skin-resorptive properties.

Cumulative characteristics appear only slightly. Cumulation index by "animals death" criterion is more than 5. Functional faults are slightly pronounced. "D-TBA" toxicity is very low: LD_{50} - 2610 mg/kg (rats); LD_{50} - 2700 mg/kg (mice). Maximum tolerance dose for rats and mice is 1000 mg/kg; Threshold dose in an acute experiment is 1/5 or LD_{50}. The compound relates to class IY of hazard. MAC for fish ponds is 0,0001 mg/L.

The bio-stimulant is used in the cases when technological process at the stations of sewage decontamination was violated for a long time, as a result activated sludge microorganisms were constantly suppressed. "D-TBA" makes for fast restoration of vital functions of activated sludge microorganisms and can be most effectively used to eliminate emergency sequences (after sudden supply of activated sludge toxicants; during volley spillage, long absence of aeration).

The bio-stimulant increases the rate of organic contaminant biodegradation 1.1-1.5 times. This allows to improve purified fluid quality (with the same aeration time) or shorten aeration time (with the same decontamination efficiency). Thereby, decontamination unit capacity increases with out any additional capital investments, energy is saved and sewage can be decontaminated to MAC level.

The bio-stimulant consumption depends on sewage composition and is in the range of 0.01 to 0.1 mg/L. For every decontamination unit the bio-stimulant consumption per sewage unit is chosen separately.

THE INCREASE OF THE EFFICIENCY OF ELECTROCHEMICAL SEWAGE PURIFICATION

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The scheme of the developed flow stations of food industry consists of 3 or 4 water purification blocks, a supply unit and an automatic machinery and management system. Initial water is conveyed to the mechanical grills, mixer-settler, bifunctional volumetric filter, electrocoagulator-flotator, multisectional electroplasma reactor, settler.

This complex permits to perform natural and flow water purification from oil products, oil, fat, fhenols, iron. Disinfection and dehelminthization can be realized by complex influence upon water flow by impulse electromagnetic field, ultrasound, low temperature electron plasma, ultraviolet radiation.

The complex construction makes it possible to change technical process greatly, including specific features of water pollution.

For example, parallel or series connection of some electrochemical blocks, depending on goal, makes it possible to achieve higher degree of purification or to intensify the purification process, concerning correlation of volume. Separate installation blocks can be used as local purification devices.

Specifications of one electroflotational and electrocoagulational module are:

- efficiency - 30 m^3/h;
- power consumption - 0,3 -1 kW/h;
- dimensions: allation - 1 x 2,5 x 2,5 m;
- supply unit - 0,54 x 1,3 x 1,9 m;
- purification degree - below standart level.

GALVANIC INDUSTRY WASTEWATER REDUCTION AND SLUDGE UTILIZATION

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The wastewater containing non-ferrous metals at comparatively low concentration (1-10 grams per m^3) can be generated in the variety of processes of metallurgical, engineering, chemical and other industries. Nowadays the wastewater of this kind is treated as a rule just before the discharge for the premises in an effort to lower the heavy metal's concentration in them.

The precipitation of the heavy metals in the form of low-soluble compounds has enjoyed in Russia the widest application as the method of purification. There is a set of variation of the performance of this procedure, but in essence all of them comes to the reducing of chromate-ion and to the subsequent hydrolytic precipitation of the heavy metals. This way of treatment leads to the partial removal of these metals from the wastewater (in the range of 50 to 700, but simultaneously it gives rise to the problem of burial or utilization of the resulted precipitates.

The investigations carried out (by our group) revealed that the precipitates of this sort might be used as the raw for production of ion-excharge materials that possesses the selectivity towards heavy metal ions. The process of the granulation of these ionites when polymers are used as binders was worked out. This method gives the opportunity to obtain the granulates that can be reused in the ion-excharge equipment, including the columns with the mobile bed. The high selectivity of the ionites of this type towards the heavy metal ions make it possible to perform the purification of 60-1000 column units of wastewater, the completeness of absorption is near 90-95.

The regeneration of the saturated sorbent is performed using the ffect of complexation. The new scheme of regeneration has been suggested and tested. This scheme of regeneration is based on the combination of the ion-excharge and the electrochemical methods. It allows to maintain the cyclic use of eluate the reducing of the isolated from solution components up to clear metals.

The present design was tested in the pilot mode.

INSOLUBLE ANODES FOR ELECTROCHEMICAL PURIFICATION OF INDUSTRIAL, TOXIC, WASTE, RISING, SUBSOIL AND SALINE WATERS

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At present the increased attention is involved with problems, connected with electroplating industry ecology, electrochemical purification of plating waste and rising waters, questions of reception of a pure water for a power, drinking-water supply. Besides purely ecological aspect of this problem, more essential becomes the economic factor - economies of precious and non-ferrous metals by their most complete and deep 9 extraction from plating wastewater and returning in a industrial cycle.

Use of elcetrochemical ways of purification of aggressive solutions and industrial wastewaters and extraction of metals permits also essentially to decrease the rising water discharge. Acidity electrocorrection and electroconcentration of solutions makes possible production of pure water for power supply without use of reactants (electroagulants of heavy metals). Electrodialysis of electroplating industry rising- water, as well as subsoil and saline waters permits to receive pure drinking-water. For all specified processes a essential problem is choice of corrosion-proof anodic material, not introducing additional pollution in a purified solution.

We have made new anodic materials, satistifying to requrements of electrochemical water treatment technology, - high corrosion-proof electrode on titanium with thin textured coating from a noble metal - platinum, iridium. These electrodes are intended for application in processes with rigorous conditions of a electrolysis, in aggressive environments, where use of the noble metal surface in quality electrocatalyst is necessary. The thickness of coating is in the range from 0.1 to 1 micrometers. The coating exhibits perfect needed texture, that provides substantial advantages of such electrodes over analogous (platinum-titanium electrodes,

manufacturing by cladding, electroplating), including:

- 3-5 times increase of corrosion resistance;
- reduction of the noble metal consumption bath in manufacturing and in use of electrodes.

Platinum-titanium textured electrodes (PTTE) and iridium-titanium textured electrodes (ITTE) are made with use of the last achievments of vacuum sputtering technology.

Successful laboratory and industrial tests of PTTE in following conditions of electrochemical wastewater treatment are conducted:

- ionolysis of concentrated acids solutions;
- regeneration of gold from gold plating electrolyte;
- gold recovery on carbon-graphite cathodes from sulfuric acid solutions;
- electro-extraction on non-ferrous metals from plating wastewater;
- acidity electrocorrection of plating waste and subsoil water;
- direct electrooxidation of cyanide up to ecologically pure products from cyanide containing wastewaters;
- electrodialysis with reversal of a current of slightly mineralized waters, ammoniac solutions, tap water.

Laboratory tests of ITTE in electrodialysis conditions of slightly mineralized and sea waters with reversal of a current are conducted.

PTTE are introduced at the enterprises of Russia and number of countries UIS. For the majority of processes the resource of PTTE work is 7-10 years at thickness of coating 0.5 mkm. Thus, wide use of PTTE and ITTE as insoluble electrodes in electrochemical purification and desalination of waters can be recommended.

MEMBRANE ION-SELECTIVE ELECTRODES FOR DETERMINATION OF SOME DRUGS IN SEWAGE

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Electrochemical methods attract attention of workers of analytical laboratories in connection with industrial demand for fast, reliable, inexpensive and fully automatical analysis. These circumstances are very important for realization of continious control of sewage and some environmental objects. Such opportunities are given by ion-selective electrodes (ISE) which permit to analyse compound objects, e.g. chemical and pharmaceutical sewage.

The selective for salicylate and acetylsalicylate ions ISE were prepared and investigated. The ionic associates of those compounds with nitrone, some basic dyes or inorganic compounds were made use as electro-active materials in membranes of the ISE. The ISE show a Nernstian behavior and theoretical slope of electrode characteristics over the concentration range 10-6 - 10-1 m. The effect of pH, temperature, the membrane composition etc. on the electrodes performance were studied. The electrodes exhibited good selectivity for the investigated preparations with respect to a large number of inorganic anions and organic substances. The ionometric methods of determination of investigated substances in sewage are worked out.

THE SEWAGE CLEAN-UP FROM CHROMIUM BY MEANS OF COMPONENT REAGENT

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The sewage clean-up of industry enterprise from heavy metal ions has importance for water protection. Therefore actual problem is elaboration production waste allows to solve problem of clean-up in complex.

We have worked out a sewage clean-up method *from chromium ions of precipitating technique* by using of component precipitated reagent which was obtained from oil-fat industry waste and caprolactam production and represent natrium salts of organic acids.

Principle of work of precipitated reagent is in forming non-soluble organic acids and complex compounds with heavy metal ions and forming precipitation coagulation that accelerates precipitation process.

The optimum composition of precipitated reagent is selected for precipitation of chromium ions to work out the conditions and subsequent operation fulfillment. Is was shown that offered method *possesses number of advantages:*

1. Practically complete chromium ions precipitation is achieved (99,3-100%).
2. The expenditure reagents compared with known method [1] at 30-35% was reduced.
3. The limitation content of initial chromium in water (before 36 g/l) is practically absent.

4. Toxic waster of food and chemical industries if utilized enough by means of transferring them in useful product using sewage clean-up.

The method permits to achieve the high level of sewage clean-up from chromium ions in wide range of concentrations that made it possible to use given method for sewage clean-up and waste chromium content solutions.

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CREATION OF REGIONAL CENTRES FOR PRODUCTION AND MASS UTILIZATION OF CHEAP CARBON SORBENTS FOR SEWAGE WATER PURIFICATION

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1. The considerable pollution of water reservoirs including the reservoirs of portable (drinking) water supply by the sewage waters containing the highly toxic contaminations - petroleum products, synthetic surfactants, phenols, heavy metals and others, demands to take the wide complex measures for the efficient purification of sewage waters in the most regions of Russian Federation.

2. One of the most effective method of deep sewage water purification, that has in many cases no alternatives, is the sorbent cleaning.

3. The advantages of sorbent cleaning are generally accepted. These are possibility of water purification practically from any contaminations, any prescribed cleaning efficiency, the absence of secondary pollutions of purified water, the absence of reagents demand, the possibility of repeated usage of sorbents by means of their regeneration, the simplicity of cleaning equipment and it is the only method of cleaning from the hemo- and bioresistant contaminations.

4. In spite of the efficiency of the sorbent cleaning, it hasn't a wide spreading exceptionally because of the high price, the shortage of sorbents and the absence of available cleaning equipment.

5. The nontraditional situation with the practically general pollution of reservoirs, which has no analogues in its scale abroad, demands to take special nontraditional and comprehensive measures.

6. The creation of regional centres for the production of cheap moderate sorbents from the local raw materials and their production are suggested.

7. The center's functions include, besides the sorbing production, the development of technical policy for optimal application of sorbing cleaning at the regional enterprises, the regeneration and reclamation of used sorbents, the organization of producing the sorbent cleaning equipment at the regional enterprises and the equipping with sorbent and servicing, the scientific-methodological training of consumers.

8. It is necessary to supply the mass production of cheap moderate sorbents for the successful realization of such program. The new technology of sorbent production is suggested for it. Its special features providing the many-time reduction of price consist of the "inclusion" of sorbent production technology in the cycle of coal usage at the coal-fired steam plant or boiler with usage the existing systems of fuel supply and preparation, the utilization of all gaseous and dusty production waste in the boiler furnances and due to it the providing the wasteless production without expenses, the application of highly productive fluidized bed apparatus, the utilization of cheap raw material - the powergenerating coals etc.

9. The suggested technology is developed in the industrial scale with brown and hard coals.

10. The efficiency of the using of new sorbents is confirmed by the results of investigations and tests at the industrial objects of different branches fulfilled by the specialized organization (VNIIVOD GEO, Kazmechanbor and others).

11. Just now the described technology is created in the Kemerovo region.

INVESTIGATION AND FORECASTING OF SALT RIGIM FOR LANDS IRRIGATED WITH WASTE DISPOSAL WATERS

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The regime and the balance of subsoil, underground and surface water are disturbed. It changes the geological rotation and manifest itself, first of all, by drawing supple-mentary mass of water-soluble salts into the geochemical migration progress. All these processes are accompanied by natural- water quality deterioration.

Sufficiently voluminious literature both home and foreign are devoted to the matematical models of the salt-carring processes.

It is necessery to clasify the models:when you choice that or other model to solute the problem of the ground hydrochemical conditions from concrete investigating object.You ought to divide the total model stream, first of all, to the scale sign-one dimensional,two-dimansional (with regard for two-coordinate change), three-dimansional the last ones are the objects analyses demand to (and,it is possible) investigate on three spatial coordinate.

Then the models can be divided into two classes: the models of engineering character, which takes into account minimum quality of significant factors and are the simple rough enough forecast instrument for the practical workers. The others are the models of the scientific theoretical character, which takes into account polyconnection of the water-object factors. The last models get predominant development despite their seeming complicational from standpoint of the filling by imitial dates. The following cut of the matematical models decision you may carry out by the significance degree of the water-object:it is the water-object of the republican, or town, or enterprise scale.You can choice in optimum manner the suitable model for the practical work by matematical or (more rightly) computer mass cutting.

The auther under the d.g-m.s. Abdrahmanov R.F. guidance has been occupied investigation of water-salt conditions of the plot, which is irrigated by the sewage from the large pig-breeding farm.

Utilize waste-water products have the mineralization in compound chemical complex about 3.1..5.5 g/liter which determines by the complex of liquid manure, water used for wash and disingfectant remedy. They relate to soda type (rHCO /rCa + rMg to 10) by their ratio among ions.Sewage are diluted with White river water 4..5 times and come to the irrigation plot with mineralization 1.5..1.8 g/liter.

Volume of diluted sewage reach 2.6 million m. This volume are utilized on 3 plots, which are not far from each other. Their total area 450..500 hectares (desined 1000). In that way average water volume on 1 hectar gets about 6000 m during the watering period.

Volume mass the chernozem increase (from 1.0 to 1.31 g/sm) the result of the sewage irrigation. You can register the deterio-ration of their water- and aeropermeability with the total chink-bility lowering (from 61.38 to 47.80), sodium content increase to 5 % equivalent in ground absorptive complex (before irrigation not more than 1.9 % eq). Potassium content increase to 20 % eq (0.8 mg-eq). The mineralization of soil solutions in separate cases reaches 0.228..0.342 %. The level of groundwater reaches 1..7 m, the mineralization of water gets 1.4..2.7 g/liter at the plots without drainage. There the chemical composion become chloride-hydrocarbo-nat, sodium calcium.

Hydro-chemical forecast was carried out with these of the mathematical methods for the purpose of clearing the direction of subsequent changes. It was based on the matematical models of salt carrying considering the basic facts in polycomponent solutions filtration and their realization on IBM.We have used the model (Idarov,1985) of combined carrying of several ions, with regard of the stable dynamics of ionic exchange sorption.

The calculation shows that chernozem practicable should be salt within the next 4..5 years (10..12 years from the beginning of the exploitetion of the irrigation lands) if the existed watering and irrigative standards should be conservate.

It present time the observation of water-salt conditions of irrigate mass and the work on matematical models systematization, which describes processes of polycomponent solutions carrying in nature water are in progress.

THE PRINCIPLES OF STANDARTISING OF POLLUTED WATER ESCAPE AND SEWAGE WATER SENDABLE INTO SEWERAGE

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There are different methods of finding of maximum permissible concentration (MPC) for the polluting compounds whith sewage into biological purification plants of sewerage.

Firstly the active sift isn't able to join to those compounds and achieving the project degree of purring such standards are given to adjuster firms and according to the law, are to be affirmed by the local administration. There are no standards on

MPC which are given to purification plants of sewerage. Another problem is the content of heavy metals in the surplus active sift taken from purification plant. No one of the pointed methods of utilization and burial of surplus sift, except the using them in agriculture isn't good for municipal purposes. The concentration of heavy metals in the surplus sift is proportional to their content in sewage which run to purification.

Thus we have three methods of determination of MPC of the polluting compounds in sewage water which are to be escape. The methods give different results. Besides they widely use them in West Europe and Germany.

Analyses show that the most strict demands to the sewage waters with heavy metals are because of the necessary to provide their maximum permissible concentration in surplus sift shile it's used in agriculture.

In the report these confront MPC for sewage water in Russia and abroad. In some cases the differences between are not explainable and are quite subjective.

We connect the question of standartising of escaping sewage water with the tax for it. There is the concentration in report that the determination of MPC makes baseless financial privileges for the enterprises which escape toxic compounds by owing to other users.

The authors suggests the scheme. While working out the standards of MPC for the polluting compounds which are escaped into sewage it is necessary to proceed from (1) the recommendations of the adjusting plant; (2) the practically degree of purring and standards of MPC; (3) The coefficient of accumulation of the polluting compounds in surplus sift and organic fertilizers. They choose the least of standards.

Pointed standards of MPC have the physical meaning for all the sewage which are to be purred. Practically the concentration of the polluting compounds of different enterprises are different. Thus one enterprises escaped more polluting compounds than other. For different enterprises they determinate individual permissible concentrations on different polluting compounds they take into consideration the technical level of local purification of sewage water. They determinate the higher tax in comparison with the ordinary tax.

The scheme is based on: (1) the local purification is cheaper than the purification of the joint sewage water; (2) all the enterprises must have equal rights to escape the polluting compounds; (3) they ought to pay for privileges; (4) we mustn't make man-made difficulties but take into consideration the technical possibilities.

The report is illustrated by facts on: (1) lists of MPC for polluting compounds; (2) practically concentrations of polluting compounds in sewage water; (3) the content of heavy metals in surplus sift and (4) known MPC for heavy metals in surplus sift.

ADVANCED METHODS OF SEWAGE PIPELINE RELINING

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Relining is the most popular and efficient method of pipeline rehabilitation. Sliplining with an impregnated hose which hardens inside the pipe (in accordance with the accepted classification 1 50), thus forming a new plastic pipe inside an old one is one of the techniques.

This technology is widely used in different countries. The techniques and materials vary from company to company giving, however the same result in the form of a rehabilitated pipe section. Mosvodokanal State Enterprise has developed and patented in Russia the method of plastic hose rehabilitation. The application for international patent is under the consideration.

The process includes the following stages:

- cut-off of the pipeline section to be rehabilitated, cleaning (mechanical, hydrodynamic);
- sliplining of the impregnated hose; installation of plugs into the hose;
- supply of heating agent, i.e. saturated steam into the hose, curing of the material; plug removal, handling the pipe ends.

As a results a new plastic pipe is formed inside an old one.

Mosvodokanal has designed a mobile self-contained repair set which includes a mobile boiler and a van for material transportation.

The materials of plastic hose and its thickness are chosen depending on the state of the pipeline and operational conditions.

Plastic hose is made of glass fibre, synthetic felt etc. impregnated with polyether resin. It has a film hose inside which serves as an inflation material.

The entire average technological cycle is 6 hours, including the preparation work; curing temperature about 100 degrees Centrigrate.

The diameter of the pipeline subject to sliplining is 150 - 450 mm, the length of a single cycle pipe section - 100 m. The plastic hose was tested in Germany for meeting the operational standards of European Association for Pipeline Rehabilitation.

The presented technology is applied for repairs of the Moscow sewerage system; besides, experi-

mental works were carried out in Germany, and demonstrated at the International Symposium in Poland on the pipeline 129 m long.

At present Mosvodokanal has got a number of orders from foreign countries (Germany, Argentine) for rehabilitation works by this method.

NEW METHOD FOR INDUSTRIAL ENTERPRISES AND FILLING STATIONS SURFACE WASTEWATER TREATMENT

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According to the recent research studies surface wastewater contains considerable amount of toxic chemical substances both of organic and inorganic origin as well as pathogenic microorganisms adversely effecting the flora and fauna of water objects and making these water objects unserviceable for fish breeding, drinking, recreational and domestic water use. The peculiarities of surface wastewater composition and quantitative characteristics depend on a number of various factors: geographical location of the region, intensity and duration of seasonal atmospheric precipitation, type of topsoil, sanitary condition of water catchnent area, predominant wind direction, availability of industrial zones nearly situated, highways as well as traffic loads.

MOSVODOCANALNIIPROJECT Moscow Institute for Water & Wastewater Research & Design has developed a complex of facilities for catchment and management of meteorological water, watering & washing wastewater and sludge. Treated wastewater may be used for territory and greenery watering; for water reuse systems and boiler houses supply as well as for the needs of the treatment plant itself. Treated wastewater may be also directly discharged into water objects since the quantity of residual pollutants meets the requirements for ponds of fish breeding quality. The Surface Wastewater Treatment Plant layout includes the following: intermediate storage tank, grain filters, reusable treated wastewater reservoir, sludge bed and oil products separation column.

MOSVODOCANALNIIPROJECT Institute has developed a number of standard dimensions of treatment facilities depending on the water catchment area size which makes up 0.5-0.36 per cent of the total surface wastewater disposal area. The equipment, the tanks and the filters are located in a single block. The facilities are operated in a semiautomatic made; energy consumption is 5-45 kW. The usage of treated surface wastewater for industrial purposes saves up to 100 m^3 of drinking quality water for a water catchment area of 1 ha.

The new method for surface wastewater treatment developed by MOSVODOCANALNIIPROJECT Institute is patented. It is approved by Moscow sanitary inspection and expert authorities such as GorSAS, "CUREN", MOSCOMPRIRODA and COSGOREXPERTISE.

For the treatment of wastewater resulted from cars washing MOSVODOCANALNIIPROJECT Institute offers a dual - train plant layout including mud collector, grain filters, reusable treated wastewater reservoir and pumps. Treated wastewater residual admixtures content meets the requirements of valid standards and sanitary norms.

THE ADVANTAGES AND DRAWBAKS OF THE SORPTIONAL METHOD FOR SEWAGE WATER TREATMENT FROM NON-FERROUS METALS

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The sorptional method of water treatment from metal cations has the following modifications: by the sorbent type, either mineral or organic; by the mode of realization, either static or dynamic. The organic sorbents call for dynamic conditions of application which imposes limitation on the mechanic purity of the water treated. The mineral sorbents, especially the gelatineous ones, to whose study we dedicated many works in both laboratory and commercial conditions, possess a high selectivity of non-ferrous and heavy metal cations and convenient for the application in static conditions, which removes the restriction to the water mechanic purity and permits converting to the solid state of all kinds of water contaminants in a compact form.

The equipment for gelatineous mineral sorbent making is much simpler than for granulated sorbents; in terms of the cost and the environmental considerations as well, the preparation of gelatineous sorbents-oxyhydroxides (Fe-, Ti- and Zr-gels) is much simpler, cheaper and more environmentally friendly than the granulated sorbents. The way of

preparation of the gelatineous sorbent used by us for the effluent industrial water purification from Cu, Ni, Cr, Mn and Pb cations consisted in precipitating of the iron (III) amorphous oxyhydroxide from its sulphate and chloride solutions by adding an alkali up to establishing certain suspension pH; then the oxyhydroxide together with the supernatant solution or without it was placed into the water to be treated. The process of purification requires only mixing and maintaining of the necessary pH value in the suspension.

The present modification has one drawback: the treated solution gets contaminated with some quantity of anions of the salt used for the oxohydroxide gel preparation. The necessity of filtration or centrifugation is no drawback as it provides the contaminant precipitation in a concentrated form, which is easy to process. It should be noted that the modification described is preferable to be used of brines from nonferrous metals, since in this case it is possible to select the initial salt for the gel making with anion, which can be of the same name as the brine composition.

APPLICATION OF ELECTRODELESS ELECTROCHEMICAL REACTIONS FOR PURIFIICATION WATER WASTE

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Authors were proposed a new branch of scientific research related to high energy chemistry and electrochemistry: electrodeless electrochemical reactions. This reactions are passing in the solution between the substances, containing in the solution, solvent and carrier of electric charge, passing to solution under action external electrostatic field. The course of reaction in general case depend on components of solution, nature of solvent, gas components in solution interface and on the strength and direction of electrostatic field. The reaction may be realised with use different UV-radiation, ionising radiation of electron accelerators special tape.

It was analysed a reaction, which may be occurred in ecology: decomposition of cyanides, sulphides, organic compounds (benzol, phenols, water solution of oil, gemicellulose) and surface-active substances, which may contents in technological water waste. It was achieved a power of purification water waste with concentration of admixtures, which is allowed either repeatedly use some water in technology, or pour out some water in reservoir (pond, lake, river).

It was established that for many substances the yield of electrodeless reaction is about 10 times greater than for analogous radiation-chemical reaction. A possible consumption of energy for purification 1 cubic meter of liquid is 0.5 - 0.1 kW-h depending on the concentration and composition of impurity.

The method application in projects, where the possibility of purification water waste which originated from industrial and agricultural activities with using electron accelerators was considered, allow to decrease expenditures for purification structure about 10 times and to decrease consumption of energy for treatment water waste.

SEPARATION OF THE SUSPENSION SOLID, OIL FROM WASTTEWATER CONSTRUCTIONS AND APPARATUSES

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There are wastewater varieties contenting suspension pollutants having differente nature and dispersal very much. It is often the pollution suspension of the industrial wastewater are the loss of good products ,therefore the se-parating sludge should be utilized.

Since the techology processes wastewater of the plant contents different nature pollutants and it is allowed useing of different level treatment water, the loacal technology wastewater treatment and the secondary using treatment water has the actual value. In this case the treatment installation should be combined with the base technology facility and

will be alogical finish. At the present time the designing of the industrial plant is carried out without the combining of the besic and wastewater treatment installations.

The application and selection of the method and fecility of the suspension pollutant seporation depend on many factors: the wastewater quantity, concentration, degree of dispersion and suspension pllutant nature. The hudraulic and the hudradinamic of the flow have the value vary much. It is indicated the suspension particles exist inteaction constantly. The interaction forces depend on nature of their (particles) surfaces.One of the positive thing of this interaction is their agglomeration. This fact intensifies their separation process. The suspended solids agglomeration depends on the hudradinamic condition of the facilities.If the necessery conditions of the flow is supplied it can increase efficiency of the treatment wastewater.

The wide reseaches of the agglomeration function are carried out in the institute VODGEO.The reseaches are carried out on different treatment facility.The rational hudraulic condition were determined for some suspended pollutants. The reseach results indicated the rational parameters for the estimation of the dispersed fase changing is specific surface. It is determined by the experimental informations of the sedimentation kinetics The programme of computer aided design is warked out.

It was determined experimentaly that the agglomeration take place between different size particles as a rule. This effect indicats the uniformity of the different suspended solids separation processes, for example , sedimentation and filtration.

In the institute VODGEO several kind of compact wastewa-ter treatment apparates are designed. Thier efficiency were tasted in the industrial conditions. Thier designing were took account of the hudraulic condition regulation provision for more high wastewater treatment effect. The recommended apparatus are multi-tier thin-layer settlers,open and multi-tier hudrocyclones, flotators, filters. Their application and selection depend on the industrial conditions,wastewater characteristics and the demanded treatment effect.

In the institute the common methodology is developed to detetmine the flow hudraulic and hudrodinamic in the constractions and the diraction of their reconstraction. Among developed constractions the combining multitier settler-flotator and the filter constraction are practic interest.

The filter constraction differentiates of the drainage system and the periodic intensive regeneration unite using against colmatation.

COMBINED MODULES OF GALVANIC WASTE WATER PURIFICATION

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Results of purification the zinc-containing washing water obtained by electrolysis and galvanocoagulation were comparatively analyzed. It was show that galvanocoagulation has an undoubted advantage, because it enables to remove not only ions of heavy metals, but anions also, when using powdered electrode materials. Initial concentration of the main component in washing water, flowing rate of solution through the galvanic couple material, components' ratio in electrode materials (aluminium, black) were defined. in order to obtain the highest degree of galvanic waste water purification and to ensure the quantitative washing with return water it is advisable to use modules, which combine sorption pr ion-exchange techniques with electrochemical ones.

Combined module, which involved electrochemical purification and currentless setting with further final purification by ion-exchange fibres is proposed. Model solutions of copper sulfate with concentration of 0.1-10.0 g/l and washing water of printed-circuit cards' production were used as the object of purification. When investigating the setting process, influence of material, electrodes' area, space between electrodes and duration of the process on a degree of purification were also studied.

During investigation of electrochemical purification, potentiodynamic curves on electrodes made of platinum, stainless steel, aluminium and graphite were plotted. Potentiostatic investigation of potentiodynamic curves was performed at their potential peaks.

For final purification the ion-exchange fibres, synthesized in Textile Institute (S. Petersburg) and Technological Institute of Saratov State Technical University, were used. It was defined that the most effective final purification can be achieved with fibres made of acetatecellulose. The exchange capacity of these fibres is not affected by their further regeneration.

DEVELOPMENT AND RESEARCHES OF WORK OF THE VERTICAL AEROTANK FOR BIOLOGICAL PURIFICATION OF THE WASTE WATER

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The biological methods of purification of the waste water have found wide application. The defects of typical structures for purification are high price of capital and working costs. The purpose of the given research is development the vertical aerotank - the VAT, which will allow to increase the process of biological purification by increasing dozes of the active sludge and by the best use of oxygen of air.

For biological purification of the waste water of food combines was tested the vertical aerotanks. Thanking design features in the vertical aerotank uniformity of mixture of a liquid on whole volume of the apparatus was provided.

With the help of horizontal plates the space inside the VAT is divided on section. A situation and the design of apertures on a plate determines a direction of rotary movement of a liquid inside each section. At transition from plate to plate the liquid changes a given direction rotary movement on opposite. Thus a liquid in the vertical aerotank VAT goes upwards.

For reception of a similar mix of the waste of a water and active sludge in between plate space, the vertical aerotanks VAT is equipped remote pulsater. With the help pulsater in a working zone the vertical aerotanks VAT is created a mode of reciprocating movement. For one cycle impulse in each section of the vertical aerotanks VAT the direction of rotary movement twice varies.

It provides the best mixture of the waste of a water and active sludge in between plates space. At the same time, at the expense of division the vertical aerotanks VAT on height cleared and the waste water are not hashed among themselves. The waste water passes all stages of the purification.

Hydraulic tests have shown, that in the vertical aerotanks VAT e does not exist of stagnant and flowing through zones. Results of industrial tests have shown, that the process of the purification of the waste water can be conducted at a doze of active sludge more than 10 mg/L. The efficiency of use of oxygen of air reached 76 - 82 %. All this brings the best results to the process of the biological purification, increases quality of a cleared water, reduces duration of process of clearing.

Received results have allowed to develop industrial blocks of the biological purification of the waste water by productivity from 50 up to 5000 m^3 in day. The industrial block consists of the vertical aerotanks VAT, apparatus for branch of a cleared water from active sludge. The block is completed by the equipment for disinfecting cleared water, installations for derwatering active sludge, pumps and aero equipment. The block is placed in hangars of factory manufacturing.

INTENSIFICATION OF LARGE SEWAGE SCALE TREATMENT PLANTS (STP) AT BUILDING AREAS DEFICIT CONTEXT

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The method of biological treatment of sewage due to efficiency and reliability has received wide distribution in world practice and will be developed in future. In our country the rates of construction STP were until recently rather high: only at the last 23 year, since 1972, sewage treatment plants in 122 towns are constructed, under construction in 42 towns of Russia.

The scope of the population by centralised sewage systems makes 75% including 70% sewage passed through STP. At the result of redundant sewage input treatment degree in many STP does not meet the requirements of water discharge.

It should allocate four STP main conditions, requiring their conclusion on reconstruction; transhipment under the sewage charge; transhipment on concentration of pollution; complex transhipment; transition to deep clearing with removal nutrients.

Water sourses of Russia are concerned by ecologists to fishing economy sourses, in this connection on STP it is required to execute deep clearing (BOD and contents mixed liquid suspended solids (MLSS) 3mg/l) at simultaneous deep withdrawal nutrients (nitrogen and phosphorus). STP operate under the charge at 1.5-2 times, at a sharp deficit of the building areas under expansion, the decision of a problem requires acceptance unequal of the decisions.Acting STP almost insuperable and requires serious modernisation. On an example the reconstruction acting STP at Solnechnogorsk with daily capacity 27000m^3 foresees the increase daily capacity to 50000 m^3 at maintenance of deep biological treatment with removal nutrients - all requirements at building areas deficit context.

SANITARY-PARASITOLOGIC QUALITY CONTROL OF THE WASTE WATER USED FOR IRRIGATION

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Using of waste water for irrigation - the reliable method for protection of surface water sources from pollution. At the same time it is epidemically dangerous because not-cleaned waste water consists a lot of pathogenic bacteria, viruses, protozoa, eggs of gelmints.

Results of our studies of the irrigation fields in the Moscowsky, Kievsky, Kaliningradsky, Kustanaisky, Belgorodsky, Rostovsky, Krasnodarsky regions, Azerbajan and Moldavia shows that:

- in waste water may be eggs of 18 types of gelmints, and also enteric pathogenic protozoa cysts (lamblia, cryptosporidia and so on) are varied form several items to several thousands in one liter of waste water;
- conventional waste water treatment systems (plain sedimentation and biological filters) are not generally effective in remaining gelmint's eggs and protozoa cysts. Sedimentation removes 17-54% of eggs and 8-31% of cysts, biofiltration and aerated lagoon - 86-98% and 78-86%, respectively;
- using of waste water for irrigation may result the contamination of soil and plant by gelmint's eggs and enteric pathologic protozoa cysts;
- eggs of gelmints (ascaridia and trichocephalus) can have a significant role in the spreading of diseases among service personnel and population living around.

Materials of studies being used as the basis for checking of quantity criteria for parasitic indicators of waste water quality used for irrigation, which can provide its epidemic safety (see table).

Table. Parasitological indicators of waste water quality used for irrigation.

Indicators	Admissible contents in 1 liter
Alive enteric pathogenic protozoa cysts (dysenteric amoebae, giardias)	less 1
Alive gelmint's eggs (askarides, trichocephalos, toksocar, fasciola, teniidae, gimenolepis nana)	less 1

The mentioned above quantity criteria for parasitic indicators are completely correspond to recommendations of WOZ (1992) concerning safe using of waste water in agriculture.

Including of such quantity criteries of parasitic indicators if the "Requirements for quality of waste water and its drops used for irrigation and fertilization of" (accepted by Ministry of agriculture and food of Russian Federation at March 9, 1995) allows to increase effectivity of control for quality of waster water and provides the reliable protection for environment and population health.

TECHNOLOGY OF LOCAL TREATMENT OF HIGHCOLOURED WASTE WATER OF HYDROLYSIS'S MANUFACTURES

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As it was mentioned in the report of ecology's commitee, the enterprises of microbiology's industry are the dirtiest in discharging in water reservoirs in the Pribaikal region. The waste water of these enterprises influences the indexes of the surface water quality even at the distance of 1 km below the discharge points. The current scheme of the mechanical and biological treatment does not provide complete extraction of colloidal and suspended solids and specifically ligninum-guminum substances. The quality of the treated waste water is not satisfactory on criteria for their discharging in the water reservoirs on indexes such as weighted substances, BOD, COD, color.

The main source of organic pollution in the total flow of hydrolyze enterprises is the post-yeast fermentation containing 70-75% of all pollution on BOD, but its volume is only 50% of all. To reduce a load on the manufactory's treatment works, the biological pre-treatment of the post-yeast fermentation at the local treating constructions-biooxidizers takes place at the hydrolyze plants. In this case the pollution of the local flow on BOD is reducing by 46% and on COD by 25% (on the base of Ziminsky

plant). The ratio BOD and COD being 0,2 shows the impossibility to have more complete bio-chemical oxidizering and it testifies of the necessity to combine biological and chemical methods of treating waste water of this type.

The investigations on chemical precipitation of ligninum-guminum pollutions from post-yeast fermentation were held at the biooxodizering unit of Ziminsky hydrolyse's plant by using coagulants and flocculants. The application of aluminium sulphate and Sanfloc made possible to get an additional effect of treatment in colouring by 87,2%, on COD - 87,5%. The final treatment of local flow lowers the loading on manufacturing treatment works and makes possible to reach standard norms on discharging waste water in natural water reservoirs.

PROTECTION OF WATER BODIES FROM THE POLLUTION WITH THE TECHNOGENIC SUBSTANCES OF NON-FERROUS METALLURGY

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As a result of technogenic impact, hundreds and thousands of hectares of the fertile soils are covered with dumps, industrial processing changes the nature relief, the landscape character and structure, its hydrological regime and flora on the whole. as a result of deflation and water erosion the most part of the polluted elements is transferred to the surrounding soils. Besides, the considerable part of polluted elements is transferred to large distances and is settled on the surface of vegetation and soil. As a rule, sewage, formed at the technogenic province and having close contact with technogenic elements (mainly with dumps) are polluted with metals, sulphate- and chlorine-ions and with other components, the concentration of which is very high.

There was held the investigation of 3 mining factories of the non-ferrous metallurgy in the Urals. The results of these investigations are given in the table. It is clear that waters of these objects are polluted with metals in concentrations which will be enough for the profitable accommodation of these metals into suitable production.

That is why our technologies are aimed at decreasing of the polluted elements' concentration in dumps and at deriving them into commodity output, which will decrease the damage of the environment pollution, and further chemical and biological recultivation will practically exclude such a damage.

The essence of this technology is as following. At the first stage the dump is subjected to chemical or biological treatment in order to derive

valuable components, which pollute the environment into the necessary production. At the second stage the fixation of the latter polluted elements in the dump takes place. The third stage consists in biological recultivation in order to prepare it to different needs of the economy.

Thus, these technologies allow not only to improve ecological situation in technogenic provinces, but also to gain profit from the realization of the product. The time of recoupment of the capital investments is from 1 to 5 years.

Table. General characteristics of the investigated objects

Name of the exponent	Volume of the exponent		
	Levichinsky mine	Bashkir metallurgical plant	Gaisky plant concentration mill
Place	Sverdl. obl.	Bashkiria	Orenburg.obl.
Mass of the rock in dumps, mln t	more than 3	10	500
General volume of waters, coming out of the dumps, cub.m/hour	250-300	5-10	20-50
Concentration of copper zinc pH	 150-180 60-150 2,5-2,8	 300-1500 100-400 2,1-3,4	 100-500 до 300 2,5-3,5
Possible metal production, t/year copper zinc	 250-300 100-150	 100-200 до 200	 до 1000 до 700
Time of the recoupment of capital investments, years	3-4	2-3	1-2

IRRIGATION WATER DERIVATION AS A FACTOR OF ANTHROPOGENIC LOAD ON THE ENVIRONMENT

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Intensive agricultural processes in irrigation farming as a rule are linked with the disposal of great volumes of saline and polluted drainage waters. It leads to the formation of a new type of water bodies - non-terminal storage reservoirs - accumulators of drainage waters, the main feature of which is a hydrological and especially, hydrochemical regime. At initial stages of filling, water ecosystems of this type present balanced saline waters ichtyocenosis, the biological productivity, succession processes and time of existence are depend on the rate of salinization. At the same time various pollutants, especially persistent pesticides, found irrigation drainage waters and accumulated in non-terminal storage reservoirs, can decrease the saline resistance of fresh water ichthyofauna. To identify the duration and terms of hydrobiocenosis functioning, we present the methods of modeling and ecological forecasting of storage reservoirs ecosystem transformation depending on variability of their hydrological regime and rate of salinity under the impact of drainage water discharged from irrigation.

The theoretical, experimental and natural study of these problems is illustrated by the example of lake Manych-Gudilo (the South Russia), the hydrological regime and ecological situation of which is under the impact of water derivation from irrigation. The main aim of the investigations is to establish the method of management of hydrodynamic and diffusion processes in the lake Manych-Gudilo. This can be attained by means of the lake decomposition into a special chain of separated parts. In the last one must be organized flow-off of salty and polluted water and accumulation of salts and other pollutions. Then the concentrated salts would be extracted out by technological means. In order to chose real parameters of the flows and to predict the distribution of various conservable or chemically active ingredients, which are depending on water exchange parameters in the separated parts, we have suggested a set of hydrophysics models. These models are based on the equation, which describe the advective-convective diffusion and turbulent transport of solute pollutions. The data of hydrochemical observations and reconstruction made in different period of time are presented in Table.

Table

Year	Salt storage (mln. tonnes):	
	"observed"	due to reconstraction
1953	13.18	12.97
1956	18.16	18.06
1960	23.16	22.83
1963	27.08	26.15
1989	47.71	47.73

SEWAGE WATER PURIFICATION PLANT: LOCAL SYSTEMS OF SEWAGE WATER REMOVAL USING HARD FILTER MATERIALS

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Series of new solutions of sewage water purification plant is offered (septings, filtering wells, filds of underground filtration, filtering trenches), based on application of composite filter materials (polymerconcret, fibrolite, arbolite etc.) and constructed elements on their basis. One layer, multilayer and compllex filter elements (with voids to put capsules of filter film materials filled with nessecary sorbents and other reagents) may be used in sewage water purification plant constructions.

These solutions favour improvement of plants functional and exploitational characteristics and, in some cases, combination of separate sewage water purification operations, for example, sewage water gravitational separation and their reagental treatment. The use of these materials instead of traditional sand and gravel filters and perforated parti-

tions promotes the effectiveness of sewage water purification plants functioning and simplifies their exploitation, in particulare it gives possibility:

- purposefully, depending on sewage water composition and amount, to change structural and physical-mechanical characteristics of filtering elements by means of initial composite material selection and technological process parameters;
- to carry out operative replacement, washing out and repeated use filtering elements and fully mechanize this operation;
- to produce filtering elements practically of any necessary form and sizes;
- to create favourable conditions for formation of biologically active films.

NITRY DENITRYFICATION OF WASTE WATER

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The last years, because of intensive evtrophication of streams there was the urgent necessity of removal from urban and industrial waste water of nitrogen and phosphorus. Therefore the requests to the contents of these components in treated waste water become stricter.

The traditional biological treatment plants do not provide fulfilment of the modern norms. The actual concentration of nitrogen and phosphorus appear in 2 -10 times above extreme allowable.

Known chemical methods of removal from water of nitrogen and the phisico-chemical ways for removal of phosphorus claim application of expensive reagents and equipment, they are difficult in operation, are unsufficiently effective and are technically not acceptable to treatment of large volumes of waste water.

The heaviest interest presents a biological method of removal of biogenic elements by nitri-denitrification.

The various modifyings of the classical scheme provide intensification of various stages and all process as a whole: introduction of additional steps of treatment (second step of anoxic and aerobic zones with the same clarifier, additional anoxic zone and other); change and addition of circulating contours (cirqulation of denitrified sludge mixture in entering water, denitrified sludge mixture in an anaerobic zone, recirculated sludge in an anoxic zone and etc.); change of system of a preliminary water treatment (feeding of a part of an initial flow without preliminary sedimentation and various systems of removal of excess sludge from aeration tanks).

The institute VODGEO has worked out the cyclic circulating scheme of nitri-denitrificators aeration tanks, combining anaerobic and aerobic zones. The scheme provides parallel removal of organic pollution and nitrogen with simultaneous biological removal of phosphorus. Originally this scheme was worked out for treatment of concentrated waste waters with the high contents of nitrogen - waste waters of piggeries, poultry factories, factories of primary wool processing and other. It is protected by the patents and is introduced into practice of treatment of waste water of agroindustrial complex and at the stage of the project of stations of waste water treatment of a number of cities.

The principle of the scheme is based on cirqulation of a part of sludge mixture between aerobic and anaerobic zones. Thus oxidation of organic substrate, oxidation and reduction of matters of nitrogen occur not consistently (as in the traditional schemes), but cyclically, small portions, depending on degree of cirqulation. In result, processes nitry- and the denitryfications proceed practically simultaneously, that lets to remove of nitrogen matter without use of an additional source of organic substrate on 85 -98 %.

Essential advantage of this technology is also the fact, that its realization is possible by re-equipment of existing aeration tanks in aeration tanks nitry - denitrificators with cirqulation of sludge mixture. Thus, as a rule, there is no necessity in construction of additional units.

The optimum technological mode in aeration tanks nitri-denitrificators forms on the basis of experimental kinetic equations, letting to calculate a required ratio of volumes anoxic (anaerobic) and aerobic zones at maintenance of balance between the transforming forms of nitrogen and oxidation of organic substance at each stage of treatment.

Other, not less important, settlement parameter of the cyclic schemes is the degree of cirqulation of sludge mixture between zones, influencing on time of a water treatment in each of zones and frequency of alternation of cycles. It, in turn, influences on efficiency of removal of nitrogen. Large volume of experimental researches of processes nitry denitryfications for various kinds of waste water has let to evaluate kinetic constants for development of the special computer program, which lets to calculate kinetic and technological parameters of process.

At fulfilment of modern requests on a discharge of treated waste water as in a stream, and in systems of sewerage the worked out scheme is universal and can be applied to clearing of waste water with unsufficient contents of biogenic elements, in particular, yeast production, when the nitrogen and phosphorus are entered in addition, for maintenance of a necessary ratio BOD: nitrogen: phosphorus.

ADDITIONAL PURIFICATION AND DECONTOMINATION OF SEWAGE WATER AT STOCK-BREEDING INSTALLATIONS BY ABSORB-RADIOACTIVE METHOD

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Industrial sock-breeding production with the high concentration of animals on a small area predetermines formation and accumulation of a big volume of sewage which is characterized by high persentage of very dangerous organic and mineral substances.

At present time there is not yet method of convention, decontamination and utilisation of sewage which could be effective, corresponded requirements of environment protection and economically acceptable.

The practice of use of purification plants at stock-breeding installations shows us that even double biological purification of sewage does not guarantee a lowering of chemical and bacteriological indices of sewage up to value corresponded to sanitary norms.

During draining into water reservoirs or reuse of sewage for technological needs it is necessary to purify or deeply purify sewge with decontamination or extraction of mineral and organic substances.

A number of institutes has conducted studies of methods of additional purification of biologically purified sewage at stock-breeding installations. It is determined thatv reagentive method of purification is characterized by high consumption of reagents, unwieldly system with high level of sediments which can not be utilized. By chemical and biochemical oxigen consumption the effectiveness of sewage purification was 40-50 %. It was ascertained that even big doses of ozone for additional purification and decontomination of sewage decreases chemical and biochemical oxigen consumption by sewage to 45 % only. The filtration method decreases chemical and biochemical oxigen consumption to 15-20 %. Methods of hyperfiltration and ultrafiltration can not be used for additional sewage purification because of its high contamination requires permanent cleaning and replacement of diafragms blocked by undecomposed combinations and hydrated ions of salts. Additional sewage purification in sectional and cascadic biological ponds requires wide areas. The effectiveness of purification in such a pond depends on climat factors and subsoil waters inflow.

Institute of Electrical Chemistry of Russian Academy of Sciences has conducted the study in order to improve the method of additional purification and decontomination of sewage by absorb-radioactive method. Using real sewage the institute has worked out optimal technological characteristics of purification process: the dimentions of absorb-column, sewage flow speed, radiation dose, the most effective and cheapest sorbent have been determined. Based on this method a model of a reactor for sewage purification, its optimal technical parameters, technological scheme of radioactive-absorb unit and its place in the sewage utilisation system have been developed.

As a result, radioactive-absorb method of additional purification and decontomination of sewage at stock-breeding installations has been worked out. This method permits to get a sewage completely decontominated with high level of clearness which can be drained into water resevoirs or reused for water supply if the radiation dose will be bigger.

EFFECTIVE METHOD FOR UTILIZATION OF SEWAGE SETTLINGS

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Sewage settlings contain toxic compounds of heavy metals, organic and chlororganic substances, can hardly be dehydrated and when dehydrated tend to ignite spontaneously and are subject to further decomposition.

Depositing of settlings involves alienation of considerable land areas and leads to a second time pollution of the environment with persistent ecotoxins. That is the main reason why the problem of detoxication of sewage settlings is considered to be of great importance.

Special Biological Technologies Company has developed and mastered the technology for utilization of sewage settlings as insulating grounds while using and maintaining burial polygons of hard usual and industrial wastes being made equal to them.

The said technology is based upon processing of sewage settlings with activated humic acids (AHA), manufactured out of inexpensive and accessible raw material. AHA efficiently bind heavy metals ions into insoluble compounds and, as a result, they lose toxicity and capability to migrate. While the said

process is being carried out, the decomposition of toxic organic and chlororganic compounds (incl. polycyclic aromatic hydrocarbons, benzpyrenes, biphenyls, dioxins etc.) is speeded up. Being natural polymeric glue, AHA give to the sewage settlings waterproofness, that is waterinsulating capability. Filtration coefficient of sewage settlings, processed with AHA, is approximately equal to that of clays and heavy sandy loams.

The placement of sewage settlings, processed with AHA, into the dump body permits to resolve the same problems as the placement of natural grounds. However, the last ones being deficient, in most cases insulating layers are not installed, This being one of the reasons of the ecologically unsuccessful state of polygons.

Sewage settlings, processed with AHA, being used as insulating grounds instead of using natural ones, resolve one of the big city problems at the same time providing for sanitation of the ecological situation on polygons.

ENGINEERING-BIOLOGY CONSTRUCTIONS FOR AGRICULTURAL OBJECTS POLLUTED WATER CLEANING

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Reclamation landscapes have a water cleaning properties depends on a territory disposition, natural and economy conditions. But often discharge of polluted water go round the natural landscape-biochemistry barriers what is due to presence of branched man-made gydrographic net.

Therefore discharge of polluted water has to be directed through the water cleaning zones and their water cleaning properties have to be increased by making engineering-biology constructions if necessary.

The most efficient engineering-biology constructions are: dispersing outlet, settling pond, buffer pond, accumulating pond, phytofiltering channel.

Dispersing outlet is a rectangular plot on inlet slope intended for discharge and cleaning of drainage water run off from drained fields, polluted storm and thawed water run off from settlements and plants into inlet.

We recommend the following loading that we had tryed for sloping terraces: BODsum - 40-100, nitrogen - 4-6, phosphorus - 3-5, potassium - 4-6 kg/(hectare*day).

The setting ponds are made on main or waster channels of reclamation net and consist from two parts: settling and assimilating parts. The settling part cleans water from suspension. The assimilating part is planted by higher water plants what is the most important for cleaning water from heavy metals, biogenic and organic substances.

Dimension of settling part depends on kinetics of suspension separation.

Dimension of assimilating part depends on removal of polluting substances by periodical plant roots and stems removing.

The buffer ponds and accumulating ponds are made on reclamated catchment for irrigation water accumulating and also for biological water cleaning.

Year mean quantity of cleaning efficiency is: for phosphates - 28%, for sulphates - up to 70%, for iron - up to 57%, for ammonia nitrogen - upto 63%, for nitrate nitrogen - up to 16%.

Phytofiltering channels are applied for purification of polluted surface and ground water run off from territory, plots for preparing peat composts, silos trench and etc.

If territory slope is 0,04-0,08 the phytofiltering channels are applied as a cascade of intensively drained sloped plots sowed by water-liking plants. The right exploitation of this structure show cleaning efficiency more than: BOD - 80-98%, ammonia nitrogen - 92-99% and phosphates - 74-99%.

If territory slope is less then 0,01 the phytofiltering channels are applied as a cascade of channel-ponds. Bottom and constantly flooded parts of channel slope have to be planted by Typha angustifolia, Phragmites communes, Elide canadensis and Lemna trisulca.

Channel-ponds cascade efficiency depends on water temperature and kinds of polluting substances is 0,03-0,18 l/day.

ECOLOGICAL ASPECTS OF WATER USE IN AGRICULTURE

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In 1994 there were used 31.2 km^3 of water by agriculture, which made up 32,4% of the total volume of water withdrawal in Russia.

Nearly 11,4 km^3 of water were diverted for irrigation. Water disposal made up 10.7 km^3. The volume of polluted wastewaters discharged into water bodies made up 3.2 km^3 or 33.7% of total volume of wastewaters. The reduction of the volumes of applied mineral and organic fertilizers, pesticides does not reduce the negative impact of chemization means on natural environment, as far as there were remained the main sources of their entrance into subsurface and surface waters. The ecological situation on reclaimed lands is characterized as unfavorable: of 5.4 million hectares of irrigated lands 720000 ha are in inadequate state (by hydrogeological and soil indices) due to reduction of humus content, main elements of mineral nutrition of plants, salinization, increase of soil acidity, groundwater rise, depletion and pollution of irrigation water sources.

The basic ecological aspects of water use in agriculture are considered by quantitative and qualitative criteria. The necessity of studies and unified technological process of water use and water disposal in agriculture is shown with regard for ecological requirements and regulations. Main measures on the reduction of water volume used in the process of agricultural production on the reclaimed lands are envisaged.

SLUDGE PROCESSING FOR RAIN WATER TREATMENT FACILITIES

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Sludge treatment is one of the number of great problems of large cities which have not a proper solution now. The volume of contaminated sludge in Moscow is about 200-500 thousands m^3 per year from rain water treatment and transport washing facilities (data by GP PROMOTKHODY, Moscow). As a rule they contains about 0.5-5% (per dry weight) of hydrocarbons and large concentrations of metals which are often zinc and sometimes chromium, copper, lead and cadmium.

Microbiological destruction of hydrocarbons. The dominant world tendency is the rising of economical efficacy of biooxidizing of hydrocarbon pollution. Say, the costs in USA for landfill disposal at 70-ties estimated as $6-12/t, incineration more than $25/t and biooxidation $12-18/t [1]. Biooxidation became the most economically efficient way at the beginning of 90-ties because of land and energy prices' rising [2,3]: landfilling - more then $200/t, incineration - $200-500/t, biooxidation $40-150/t. Except economic the biooxidation has some ecological advantages:

- a solid waste accumulation is not, landfilling not require,
- hazardous exhaust and waste water are not,
- the compost after sludge biooxidation improve soil structure.

We developed OLEOVORIN, a new line of oil-oxidizing bacterial biopreparations, which can work from +3 to +45 °C and pH from 3.5 to 10. OLEOVORIN has all necessary in Russia state allowances. It has been tested at various soils and climatic conditions and now we actively use it in industrial practice.

We made laboratory tests OLEOVORIN technology for hydrocarbon oxidation in sludge from rain water treatment facilities. We received the reduction of hydrocarbon concentration from 30000 mg/kg to 740 mg/kg during 100 days.

Elimination of metals. We developed technology for removal metals from a sludge after destruction of hydrocarbon. During laboratory tests we received the following results for lowering of metal contents in samples: zinc from 480 to 18 mg/kg, chromium from 105 to 19 mg/kg, copper from 120 to 41 mg/kg, lead from 35 to 23 mg/kg and cadmium from 1.7 to 0.4 mg/kg.

We made estimation costs for sludge treatment, the power of facility is about 10 thousands ton dry weight/year.

The prices are:

- microbiological destruction of hydrocarbons $10-20/t,
- elimination of metals 5-25/t

After treatment the concentrations of hazardous components in compost don=t above the appropriate limits for soils.

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PURIFICATION OF HIGHLY POLLUTED LEACHATES FROM DUMPS OF SOLID HOUSEHOLD WASTE

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The growth of cities, industrial and agricultural development result in worsening environmental conditions of life of the people, especially in big industrial centers where economic and household activities are highly concentrated and the density of population within a limited territory is very high.

In the Russian urban areas about 130 mln m^3 (or 26 mln tons) of solid household waste are formed 90% of which are dumped and taken away beyond the city boundaries. The landfills are badly organised and are the most harmful pollutants of the surface and ground waters.

The rate of the detrimental effect depends on the area of dumps, the composition of waste dumped and, as a rule, by a long period of their existence.

The area of landfills which generally covers dozens of hectars absorbs much precipitation which go down through the body of the landfill. On the way to the bottom the precipitation is enriched by various compounds dissolved and dispersed in water and forms the so called "filtrate". The filtrate partially comes to the underground horizons and is partially drained down finally entering open water reservoirs; rivers, lakes, etc.

The danger of the filtrate spreading arises (stems out) from its composition. The research carried out show that the filtrate consists of different organic, element and organic and inorganic compounds having high chemical stability and toxic activity.

Such characteristics of the filtrate, as BOD exceeding 1000 mg O_2/liter (the norm is 3 - 6 mg O_2/liter) and COD exceeding 5000 mgO_2/liter (the norm is 15 - 30 mg O_2/liter) indicate that considerable content of organic compounds practically makes the filtrate penetration into natural water reservoirs impossible. The content of Cd, Zn, Mn, Cr, Pb, As, etc exeeds the norm of dumping two times.

Anaerobic processes in the body of the landfill result in denitrifying which leads to the formation of compounds containing reduced nitrogene. These compounds as a rule are surface active substances which possess high chemosorbing capacity to form complexes of heavy metalls with variable valency.

The mentioned characteristics as well as a number of other peculiarities of the filtrate composition result in concidirable difficulties when developing technologies to purify it and according to the research data they complicate the use of traditional methods for these purposes, i. e. biochemical purification, direct filtration, oxidising, coagulation, floculation, sorbtion, etc.

To solve this problem a new flow sheet was worked out. The flow sheet comprises the following main operations (stages):x modified coagulation and floculation, high energy action on the filtrate aimed at destroying stable organic and metal - organic compounds and final biological purification to remove compounds of nitrogene and phosphor.

In the course of such treatment visible destruction of organic complex compounds and release of polyvalent metals take place. The filtrate treated was subjected to biological purification at the installation with the silt collecting system.

A new technological sheme of continuous reagent-free process of deep filtrate purification of the solid household waste landfill has been developed after the research carried out.

This technology provides for gaining the filtrate quality parameters equal to those on the fish breeding farms. The filtrate cleaned has transparency in the visible and ultra-violet ranges slightly inferior to the drinking water quality.

BIOLOGICAL TREATMENT OF WASTEWATERS USING ATTACHED MICROFLORA

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Biological treatment process employing attached microflora, soil treatment being a prototype, has a new birth.

Designs of biofilters are being developed, estimation methods are being improved thus ensuring wider application for facilities with attached microorganisms.

Lately great attention has been paid to such works in the USSR and in Russia.

Experience gained in the operation of biofilters and the need for predicting process parameters in

order to extend the field of application for low power-intensive and economic in operation facilities require the development of theoretical generalizations to modify estimation methods for these facilities.

At the end of 70-th VODGEO began to develop a universal method for designing biofilters on the basis of modified equations of enzymatic reactions. Later the practical applicability of the method has been verified by experiments. At present research in this direction is continued. As a result general process design procedure will be developed for biological treatment facilities. It will allow to select types of facilities and optimal flowsheets more reasonably.

Development of designs of facilities and units with attached microorganisms progresses in several directions.

Recently so called submerged biofilters actually providing complete usage of surface contact area of phases (water + biofilm) have received a large development effort.

Owing to the expansion of plastics production various packings used to fasten biofilms may be made of such light materials. Packings are devided into three main types: I- filled up, II- plane; III- fibrous. Fibrous packings have the largest surface area.

For complete biological treatment conventional trickling and high-rate biofilters, as well as new types: tower, with plastics media and rotary biofilters are mainly employed. The field of application for the latter is limited on capacity, average and low capacity facilities are used in Russia because media is rather expensive.

As the need for deep wastewater treatment has arisen lately most effective and economic methods are being searched for advanced treatment, among them biological methods using attached microorganisms prevail.

Research work carried out by VODGEO has revealed the perspective of biosorption application in advanced treatment of wastewaters. The sorption involves adsorption of residual contaminants on activated carbon and its continuous regeneration by microorganisms attached to the surface of sorbent.

In accordance with actual requirements and general tendencies in the development of biological treatment processes VODGEO continues theoretical studies and engineering developments of units and facilities with attached microorganisms.

A number of modifications for rotary biofilters being used as a basic structure in combined prefabricated units have been developed for facilities having low and average capacities. Floating biorotors with fill-up media are recommended for aeration tanks. Designs of aeration tanks with stationary submerged media placed in containers are developed.

New facilities ,that is biosorption units with fluidized bed of sorbent and dense filter bed where continuous and periodic regeneration occurs have been developed for advanced treatment. New types and designs of packings, floating and screen types are most perspective, are being tested and developed.

MUNICIPAL AND INDUSTRIAL WASTEWATER TREATMENT IMPROVEMENT IN THE CITIES OF TVER, GAGARIN AND DMITROV

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The US Environmental Protection Agency and the Minnesota Pollution Control Agency are working co-operatively with Russian officials in the cities of Tver, Gagarin and Dmitrov on wastewater treatment facility (WWTF) improvement demonstration projects designed to protect the Moscow drinking water sources.

The demonstration projects were initiated in 1994 and address wastewater improvement practices in the following areas: 1) municipal WWTF Operation Management Evaluation (OME) Process; 2) methods to assess quality and quantity of industrial discharges to WWTFs and to control such discharges; and 3) low-cost improvements to industrial wastewater treatment technologies. A second goal is to transfer information learned from the demonstration projects to others in the Russian Federation. The Project is scheduled for completion in Spring 1997.

Project results to date include OME and monitoring training in the US for wastewater treatment operators and regulatory officials from the three participating cities, and a pilot OME evaluation in the city of Gagarin. Equipment has also been provided for more accurate sampling of wastewater treatment facility influent flows, monitoring the quality of industrial discharges and basic laboratory and process control equipment. Industrial wastewater audits were conducted at four industrial enterprises in the summer of 1995 and recommendations for potential improvement were discussed with the participating industries in September 1995. Three en-

terprises accepted and are implementing the recommendations (the fourth is not operating). Results from the one facility that has been able to complete the improvements are very favorable: after inexpensive modifications to is treatment process it is now complying with permit limits. Ongoing work will also provide recommendations to the Russian government for potential improvements regarding the regulation of industrial discharges to the municipal WWTFs.

THE TECHNOLOGY FOR LUMBER AND PAPER PROCESSING INDUSTRY SEWAGE PURIFICATION WITH CATIONIC FLOCCULANT CHEMICALS

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VPK-402 - the cation flocculant - poly-N, N-dimethyl-N N-Diallyl Ammonium Chloride - the analogy of the American flocculant "Catfloc" - is produced by an industrial complex "Caustic" in Sterlitamack.

VPK-402 is applied for refinery, limber and paper processing, mining and metallurgical industries sewage purification.

The technology for treating lumber and paper processing industry includes mixing of waster products with solution (1-2 percent) of cation flocculant VPK-402, clarification of the flow in a radial settling tank, removing and dewatering of sludge. A flocculant dose, depending on water pollution with lignin compounds, is 10-50 mg/l. To dewater surplus of active silt, the flocculant dose of 20 mg/l is added into silt mass before filtering.

Use of cation flocculant decreases water coloring to 7-10 times, Ch.P.K. - 2-3 and BPK - to 15-17 times, turpentine and tall oil concentrations - in 4 and, relatively, - 2 times, concentration of oil, chloro organic and sulhus compounds - to 20-30 percent. Also, the process of the forming sediment filtration is more effective to 5-10 times. Moisture of dewatered sludge is 40-50 percent.

A water flow purified by use of cation flocculants is not toxic for warm-blooded and hydro-organisms.

Cationic flocculant application:

- is effective for water purification to the quality standards required on the standard refining equipment;
- increases efficiency of sewage and sludge purification;
- makes better service conditions at refining plants.

MOBILE PLANT FOR LOW-LEVEL RADIOACTIVE LIQUID WASTE REPROCESSING

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The application of radionuclides in the national economy results in radioactive waste formation. Numerous research institutes and industrial enterprises and also radiochemical processes and APS (Atomic Power Stations) are a source of radioactive wastes. Although these wastes have a low volume radioactivity, the reprocessing of such wide spread wastes is rather complicated. Especially it concerns the liquid radioactive wastes (LRW) the transportation of which is always accompanied by a higher of environmental contamination.

In 1991, according to the results of scientific research and experimental designing works, a pilot mobile plant for low-level LRW processing is assembled now. The mobile plant is assembled on "MAS" - car semi-trailer nd consists of three principal modules: ultrafiltration module, electrodialysis module and filtration module. Each module is assembled on separate frame. The mobile plant is easily modified according to LRW composition and simple in control (about 1-2 assistants of serving personal). The chosen operating mode plant is controlled automatically.

The mobile plant capacity is up to 24 m^3/day, and LRW cleaning coefficients of various radionuclides constitute from 100 to 10000 depending on chemical composition of LRW and its nuclide composition. Specific energy consumption is equal to 20 kWh/m^3. The geometry of mobile plant with semi-trailer is 11.3 m x 2.2 m x 3.5 m. The plant weight filled-in with water does not exceed 12 tons.

DATEBANK OF TECHNOLOGIES FOR BIOLOGICAL REMOVAL OF NUTRIENTS FROM WASTE WATER

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An aggravation of ecological situation in many industrial countries is chiefly caused by pollution of fresh water resources by biogenic elements. The main of factor eutrophication for a number water bodies is discharge of municipal and industrial waste waters, containing detergents, organic and mineral nitrogen and phosphorus compounds. Therefore the prevention of receipt of nutrients in water sources is one of the main problems, which solution can improve environmental condition.

Conventional facilities of biological treatment do not provide purification to the required standards. The deeper removal of nitrogen can be achieved during biological nitrification and denitrification. There are some schemes of removal phosphorus by addition various types of reagents in installation of biological scheme and biological excess phosphorus removal under both anaerobic and aerobic condition. However, many currently available technical solutions, are not connected one with another to form a single system.

A certain success has currently been achieved in the development of datebank of biological nutrients removal from waste water. The work was carried out on the basis of the analysis of home and foreign technological and patent literature and summaries of operation experiences.

The developed bank of technologies presents an information about formation of contaminated waste waters, containing organic and mineral nitrogen and phosphorus compounds, orders tested in plant and laboratory condition progressive technologies and engineering solutions on their removal from municipal and industrial waste waters.

The bankdata contains the describe of methods, abstracts, bibliography. All this enable to execute operative search of a material, to solve the problem of intensive waste waters treatment most economically and to comply with drawing demands for pollution control of water sources.

DECOLORIZING PROCESSES FOR AQUOUS SYSTEMS IMPURIFIED WITH DYES

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Dye impurified wastewaters is one of the problems of interest for the experts in environment protection due to the dyes compositional and structural complexity as well as to their negative consequence upon the environment.

The concerns for studying practical implementation of some decolorizing and/or recovery processes are thus justified.

Structure-properties correlation lies at the basis of the present paper which deals with the possibility of applicating some unconventional decolorizing processes, such as adsorptive balls separation: precipitation - DAF flotation, complexation - DAF flotation and\or ozonization - DAF flotation methods.

The efficiency of the proposed processes is outlined both in high dye separation and high recovery yelds.

TECHNOLOGY FOR PURIFICATION OF WASTEWATERS DISCHARGED BY SYNTHESIS OF MELANA FIBERS AND RESULTED PAN POLYMERS SLUDGE CAPITALISATION

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Manufacturing of polyacrylonitrile synthetic fibers discharges wastewaters impurified with monomers, polymers, solvent (ethylene carbonate), fibers avivage and dyeing agents.

The wastewaters treatment by coagulation-flocculation with polyelectrolytes (6-10 mg/1) leads to an almost complete clarification of water ($n_{\text{suspended solids}}$ =72-97%, $n_{\text{turbidity}}$ =82-97%), the decrease of the total organic yeld 65-96% on COD basis and con-

fers a biodegradable character to the treated effluent.

The treatment process allows for recovering and capitalisation of the chemical polymer-based sludge (PAN sludge) in the synthetic fibers industry (reuse in this fiber industry), in the light industry (synthetic furs), in the paper industry and/or in the building materials industry.

CARBONMINERAL SORBENTS IN THE PROCESS OF PURIFICATION OF WATER, TECHNOLOGICAL SOLUTION AND SOILS

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Problems of pure water obtaining, improvement of the human environment on polluted regions are prior direction of scientists, technologist and manufacturer's work.

To solve the problem of refining of waste waters and technological solutions, the different types of sorbents are used. But the effectiveness of usage is far from expected result.

The possibility of usage of one of perspective sorbents, such as carbon-mineral granular sorbents, are examined at present work.

The data concerning the physical-chemical and structural sorbtional characteristics of carbon-mineral sorbents are presented.

Peculiarities of radionuclides and heavy metals sorption from water solution are studied. It is shown, that carbon-mineral sorbents are able to absorb radionuclides in the limit of 92-99%, concerning heavy metal - 100%.

It is defined that the total sorbtional capacity of such sorbents considerably exceeds the total capacity of separate components. It allows to make a conclusion regarding the sinergic effect of carbon sorbents.

It is disclosed that the modified carbon materials give the absolute virus distruction of extremely dangerous infections, in particular, cholera bacillus during the refining of drinking water. It is especially important for regions subjected to epidemic beginning.

The different scheme of usage of carbon-mineral sorbents for solving of various ecological tasks of waste water's and technological solutions' refining are analyzed.

CLEANING SURFACE SEWAGE FROM OIL PRODUCTS BY THE BACTERIAL PREPARATION

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Oil and the oil products are typical pollutants of surface sewage. The contents of oil products in surface sewage, going into Moscow sewage purification plants, changes from 0.25 up to 100.00 ppm. The cleaning surface sewage, as the rule, is executed on constructions consisting of settlers and filters of fine cleaning. The analysis of obtained data shows, that the quality of purified water on this construction does not always satisfy the requirements of environment protection state organizations. The most vital problem is a problem of additional surface sewage cleaning of oil products. In connection with all of this biotechnology of cleaning surface sewage from oil products, which considerably increases the efficiency of cleaning, was devised. Bacterial preparation "Devouroil" is used in biotechnology. The preparation is a powder, which contains the association of hydrocarbonoxidizing microorganisms.

Works on its application in real sewage purification plants were hold after the efficiency bacterial preparation for cleaning surface sewage from oil products was checked in laboratory in 1995.

Tests were hold on sewage purification plant "Kerosene brook". Two steps bioclean system was installed on this object. At the first step (preliminary clean) hydrocarbonoxidizing microorganisms were immobilized on a foam plastic granules surface (diameter 1-1.5 sm.). Total volume granules made 0.25 m^3. Treated granules were distributed evenly on a water surface in a settler zone. At the second step (the fine clean) hydrocarbonoxidizing microorganisms were immobilized on a surface of fine cleaning filter (sipron as base), packing in cartridges. Thus a polluted flow was filtered through a system of such cartridges. It showed that the concentration of oil products in surface sewage, going into settler, changes from 0.17 up to 3.9 ppm in dry weather. After first step of cleaning (settler zone) the concentration of oil products decreases up to 0.1-1.0 ppm, it means, that the efficiency of cleaning reaches 73 and 70%. At the same time in settler zone without biofilter the efficiency of clean was no

more than 33% at initial concentration of oil products 4.2 ppm and 11% at initial concentration of oil products - 0.35-0.76 ppm.

It is shown, that the degree of clean depends on a time of staying sewage in settler, i.e. on a time of contact with cells of microorganisms. So the efficiency of cleaning of a flow on filters with hydrocarbonoxidizing microorganisms (2 steps of cleaning) a little differed from control variant.

The obtained data show, that the application of biofilters with hydrocarbonoxidizing microorganisms permits to decrease the oil products content in surface sewage up to 0.1- 1.14 ppm at one step of cleaning. For the creation of the second step of cleaning another technological decision, which can increase a time of contact between a flow and a filter's surface, is necessary.

PHOSPHORUS REMOVAL FROM WASTEWATER FORMED IN PHOSPHORUS TREATMENT PROCESSES BY METHOD OF SHELL-GROWTH POLYMERIZATION IN WATER EMULSIONS

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Phosphorus industry is one of the those chemical industries which produces toxic wastes, including big amount of wastewater. This wastewater is sludge emulsion of white phosphorus in water. Phosphorus content in wastewater goes up to 50% sometimes. It leades to pollution of surface and ground water by highly toxic whit ephosphorus and its oxidized forms - phosphates. Because of phosphates eftrofication of water objects could start.

To create effective technology of phosphorus industry's wastewater treatment method of shell-growth polymerization in water emulsions is offerd. Not toxic red allotropic modification in form of phosphorus containig polymere is a product of this process.

Polymerization reaction of white phosphorus, which presents in sludge emulsion is initiated by radiation. This metod differs in a good way from others existing already.

Main stages of the process:

- polymerzation initiating by oxigen containing radicals on surface of emulsion particles,
- formation of "capsuled" particle of white phosphorus,
-polymerization process of white phosphorus in shell (inside the capsule) under radiation.

In parallel with the process of polymerization process of phosphorus oxidation takes place. Oxidation rate could be decreased by adding to the system OH-radicals acceptor.

Phosphorus containing polymere is a product of reaction. Composition and propeties of polymer depend on composition of initial sludge emulsion. Stability, i.e. ability to undergo Red-Ox reaction, of polymer characterizes its quality. It is very important in case this compound would be used as antipyrene in polymeric materials.

Thus, method of shell-growth polymerization in water emulsions allons to treat phosphorus industry's wastewater in order to remove phosphorus and to get phosphorus containing polymer as a product at the same time.

PROVING COMMERCIAL TEST RESULTS AND PROSPECTS OF THE HEAVY METAL IONS OFF FLOTATION TREATMENT OF PLATING EFFLUENTS

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The present report is an extension to the paper delivered at the I-st Congress (Sept., 1994) (1) and relates to the results of proving commercial run of the flotation cell for plating effluents purification at the works of JSC Velta. The cell of up to 0.3 cu. m/min throughput has been used for heavy metal ions off purification of the plating effluents high in chrome. This cell provided for electroless reduction of hexavalent chrome to trivalent chrome in the reactor, alkaline agent neutralization of the effluents in the mechanical agitator, flotation reagent-effluent contact in the mechanical agitator (2) and hydrophobized aggregate flotation in the cell. The latter is presented by the counterflow vertical column.

Bubble aeration is effected by compressed air being dispensed through perforated rubber tubes

(The aerator inlet gage pressure is 0.15 MPa, air flow is 0.01 cu.m/min).

During the tests carried out on the effluents of variable analysis (Total content of Cr (III), Ni, Fe, Cu, Zn ions varied in the range of 6.0 to 300 p.p.m.) the effect of pH 6.3-9.4, flotation reagent flow making 0.4-2.5 mg/mg of metal have been investigated. Extraction mass % is as follows: Cr (III) 99.7-100, Ni 98.2-98.8, Fe 97.2-97.7, Cu 96-97.5 and Zn 97.3-98.8. This provides for the renovated effluents to be recycled. Flotation separation in the column type cell proceeded with a high rate.

Based on above cell dispersing action of different aerators has been studied (perforated rubber tubes, aerators operating due to evolution of gas from the solution). The highest bubble dispersity in absence of a foamer is provided by pressure flotation (bubble dia. is about 0.1 mm). However in practice at the acceptable air pressure the required degree of aeration at the pressure flotation can be achieved by circulating air volume increase entailing the column overall dimensions and energy consumption rise. Moreover on the stage of flotation separation the air microbubbles cause the bubble-particle complex transport velocity and respectively flotation rate decrease.

Based on results of the studies made to reduce negative surfactant effect on the effluent quality and increase the flotation rate a new cell combining the concepts of pressure and column flotation with up to 200 cu.m/h throughput is under development.

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THE MEASURES TO TREAT THE PROBLEM OF THE BAIKAL REGION'S MUNICIPAL WASTE WATERS

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In the highly industrialized Russia's regions - which also include the Angarsk region - the most dangerous factor for people's health is intensive industrial exploitation of water resources and sewage pollution. The environmental condition of the East Siberia region remains challenging. In 1994, the Irkutsk region's water objects were polluted with non-purified (505.7 mln.m^3) and badly purified sewage (886.2 mln.m^3).

Also, 783 tons of phosphorus, 3491 tons of ammonium nitrogen and 8934.5 tons of nitrates were absorbed by the atmosphere. It is, relatively, 166:2.3:6.3 percent on the All-Russian scale; and the focus is on necessarity of the constructive means to industrial modernization.

Due to the latest statistics, the largest region's cities "contribution" to air and water pollution is: Irkutsk - 8 percent, Usolye-Sibirskoye - 23 percent, Bratsk - 23 percent, Angarsk - 38 percent, the rest - 21 percent.

The biological purification in aerotanks is most popular in Irkutsk region for sewage disposal. By the means of the cities and settlements' rectification constructions, annually 246,38 mln.m^3 of sewage is purified. Also, effluents (primary sediments, active silt) consisting of 70-80 percent of organic and 20-30 percent of mineral substances are wasted in the atmosphere. These sediments has been treated on the large special silt areas.

Metantanks, specially proved by KOS, are not exploited because of poor provision with the explosion-proof equipment.

The key measures recommended for sewage disposal are limited by the primary means aimed to sediments' volume reduction and their structure improving for subsequent use - it is compression, dehydrating, drying, incineration. The sediments produced can be used by agricultural economy as fertilizers for soil enrichment and as fodder addendum for vitamins, proteins, amino acids processing, also, as fillers for building engineering. The range of reasons are a principal obstruction to introduction of the technology advanced.

In particular, due to the sanitary standards, there are some limitations to use of the waste products processed: the constructive disinfection measures have to be conducted for destruction of pathological microflora. The process of thermoprocessing should be carried on, though it is too expensive.

Our expertise for the West Siberia ecological condition has worked out zoo methods of sewage composting with earthworms known as "Red California Worms".

The numerous experiments have showed that the complete water disinfection can be reached by this method. The compost processed is reach with high agrochemical indices which are enriched with

all the nutrient elements needed for plants and which meet the sanitary standards as fertilizers.

The compost's biochemical characteristics have been thoroughly explored, and comparison with soil characteristics has been conducted since the ferment soil activity is one of the major indices of organic matters processing into humus. While humufication, primarily oxidizes (peroxides, polyphenol-oxidizes, catalysis) are the key components for oxidizing condensation relative to plain products of ferment oxidizing.

The methods of oxidizes determination in the compost are worked through; and the correlation between the level of ferment activity and the composting process conditions such as temperature, humidity, the compost granulation index is exposed.

Due to expertise, the compost oxidizes have turned out more thermostable than ferments in solutions since the oxidizes immobilization. They begin to inactivize under the temperature of 60-70 degrees centigrade. Under low temperature, the ferment activity indices remain the same.

Ferment activity dependence on compost humidity is many-sided since this factor determines the ferments' condition in the compost and absorption level under the colloid-chemical indices change. Ferment activity changes more obviously when drying. That is why for getting the optimum agrochemical indices, it is necessary to deep the optimum humidity not to overdry the compost products processed.

The authors have recommended the optimum conditions for sewage disposal and the composts' evaluation methods due to their biochemical characteristics and the oxidizing ferments' level.

MICROBIAL TREATMENT OF SEWAGE CONTAINING SURFACTANTS AND OIL PRODUCTS

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Purification of waste water is still one of the most complicated and unseated problem of national economy. Among the great diversity of different methods of decontamination both a domestic and industrial sewage the final stage is biological treatment more often. However the blending of different flows, volley disposal of toxic components often causes a destruction of active sludge and a disruption of treatment process. The active sludge in one's turn is a serious problem too, because many tons of it reached at the many factories are very dangerous second pollutant of the environment. As we consider to normalize the biological treatment and lower production of biomass's excess the system of sewage purification plants ought to be created at the industrial enterprises that discharge a most toxic and concentrated wastes.

As a result of conducted investigations in technological field the working model plants for purification of sewage from surfactants and oil products have been created. The basis and "know-how" of this biotechnology are microorganisms with high destructive activity. The optimum reduced concentrations of pollutants are enough large, they are from 0.1 g/l to 10 g/l. Treatment technology is continuous process proceeded in multi-stage plant, that volume is comparable with daily volume of treated model sewage. Immobilization of strains on inert carriers allows to keep a constantly high cell concentration in work area and the carrying-out of microorganisms from bioreactor is insignificant. Treated by this way water after removing of microbes may be used anew for technical needs or given to the biological tertiary treatment.

The most difficult problem is utilization of complex wastes,containing simultaneously $_{surfactants}$ and mineral oils, for example spend detergent solutions (SDS) and lubricating cooling liquid (LCL). The result of our work in purification of such wastes is pilot treatment plant that is prototype of mobile purification block applicatable into certain shop where during the metal working large quantities of SDS and LCL are formed. the volume of pilot plant is 200 L, it is supplied with compressor, thermostats, pump system, injecting and transferring liquid through 4 sections of bioreacror. The main parameters of treatment: temperature 20-30°C, rate of dilution 0.2-0.4h-1, air consumption V/V per min, initial concentration of surfactants up to 10 g/L, mineral oils - up to 3 g/l, pH 7-9, effectiveness of purification 80-100%.

After removing of essential quantities of oil treated sewage may be given to the all-factory purification works. Biomass located in special cassette, represented by high-active microorganisms degrading surfactants and oil products may be used for preparation the new biological reactors and for introduction in oil-contaminated environmental objects.

METHOD FOR MUNICIPAL WASTEWATER TREATMENT FACILITIES IMPROVEMENT AIMED AT MEETING NEW REQUIREMENTS FOR TREATED WASTEWATER QUALITY

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Most of the water bodies of Russia are classified as water bodies of fishery usage. According to valid sanitary norms and standards SanPiN 4630-88 the quality of treated wastewater entering the open bodies in case this wasterwater is discharged within city boundaries. This situation exists both in the City of Moscow and in other large cities of Russia.

However, municipal treatment facilities that are built everywhere according to the traditional flow chart (mechanical treatment, biological treatment and partially tertiary treatment via the application of fine filters) do not provide the required quality and require treatment facilities improvement. The problem is aggravated due to the necessity to maintain the treatment capacity of the existing facilities as well as due to the lack (as a rule) of the areas for additional facilities construction. While solving this problem for the City of Moscow, MOSVODOKANALNIIPROJECT Moscow Institute for Water & Wastewater

Research & Design adopted the following basic criteria:

- to prevent the penetration of pollutants of industrial origin into the municipal wastewater disposal system in quantities exceeding the norms established;
- to lower the total coefficient of irregularity of influent wastewater ingress into wastewater treatment plants and some individual treatment facilities;
- to improve the existing wastewater treatment facilities and the monitoring of treatment processes;
- to introduce new technologies and some additional equipment.

The implementation of the first point is possible through the adoption of "Regulations Concerning Industrial Wastewater Admittance into Municipal Wastewater Disposal System".

The second point is realized through the construction of regulating reservoirs of special design for the municipal network and the development of automatic regulating system for the distribution of wastewater among individual treatment facilities. We plan to implement the third and the fourth points in three stages. The first stage envisages the improvement of mechanical treatment facilities:

- the substitution of fine screens for 16-mm screens;
- the intensification of grit chambers operation aimed at compulsory removal of grit fractions of 0.1 mm;
- the equipment of primary settling tanks with built-in sorption chambers; activated sludge supply into these chambers (in the range of "excess sludge - complete recycle");
- the provision of the primary settling tanks with sludge continuous pumping out (maximum concentration of 8.0 g/l) into separately installed sludge thickeners.

The second stage envisages the improvement of biological treatment facilities through the introduction of nitrogen and phosphorus removal technology:

- the division of aeration tanks into three sections: nitrificator, denitrificator and postaerator-regenerator;
- the equipment of the first section with inert filler; the equipment of the second section with mechanical mixers;
- the supply of activated sludge mixed with primary sludge into denitrification section;
- additional equipment of the secondary settling tanks with filtering elements aimed at the decrease of activated sludge wastage.

The third stage envisages the improvement of the existing tertiary treatment and disinfection facilities or the construction of the new ones:

- the conversion of tertiary treatment filters into bioreactors or the construction of new bioreactors;
- the introduction of advanced-treated wasewater disinfection methods alternative to chlorination.

It is recommended to carry out the improvement and the construction of sludge thickeners providing the possibility for reagent dosing; the improvement and the construction of the bioreactors should envisage the possibility to apply sorbents for subsequent development and improvement of sludge treatment and advaced wastewater treatment processes.

HEAVY METAL IONS EFFECT ON TYPES, MICROFAUNA AND MORPHOLOGY OF ACTIVATED SLUDGE ZOOGLEAS

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In order to prevent heavy metals accumulation in natural reservoirs and their negative effect on number and species of high invertebrates sewage biochemical purification unit efficiency must be better controlled.

On the basis of continuos experiment made on a laboratory unit imitating purification unit operation "КОС-II МП УВКХ" (City of Usol'e-Sibirskoe) with the use of General biological (COD and sludge index) and hydrobiological indexes of activated sludge, study of activated sludge microfauna physiological condition as well as cytological and cytochemical investigations, concentrations of heavy metal ion mixture (Fe^{3+}, Cu^{2+}, Cr^{6+}, Cr^{3+}) not producing (producing) toxical effect upon species and morphology of activated sludge zoogleas were found.

Activated sludge morphology remained identical to the morphology of the activated sludge in check aerotank during the experiment before heavy metal ion mixture concentration reached the following values, mg/L: Fe^{3+} = 0,43; Cu^{2+} = 0,11; Cr^{6+}= 0,18 and Cr^{3+} = 0,06.

When heavy metal ions in concentration of Fe^{3+} = 0,59; Cu^{2+} =0,15; Cr^{6+}= 0,24 and Cr^{3+} = 0,07 (mg/L) acted upon the activated sludge, its zoogleas gradually acquired lighter coloring; and large grainity, hystologically tested, appeared. The grains turned out to be rounded zoogleas, inside them fibrous structure of zooglea polysaccharide could be seen. Some cells coloration by Brachet on RNA and DNA

showed that the studied microorganisms were in a vital condition. No deviations in sodium content for the rounded zoogleas in comparison with checked zoogleas were observed. All the foregoing facts proved that under exposure to heavy metal ions mixture morphological reconstruction not producing bacteria death took place. So, this heavy metal ions concentration is not lethal for activated sludge organisms, but at the same time it is not permissible as activated sludge oxidizing power sharply drops due to the contraction of zooglea working surface.

Hydrobiological control of microfauna species and activated sludge zoogleas morphology demonstrated increased content of cysts and the emergence of dead Infusoria and Rotatoria. Mass attacks of Ciliophora and Vorticella microstomata; vacuole pulsation delay, prevailance of sexual multiplication, cystoformation were observed in the activated sludge for Protozoa and eulityc organisms. Besides, the value of purified liquid COD increased (i.e. purification efficiency decrease) and sludge index changed in this case.

HEAVY METAL IONS INFLUENCE ON SEWAGE AND PURIFIED LIQUID TOXICITY

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Up-to-date conventional evaluation of sewage quality only by chemical indexes does not completely represent sewage properties and the possibility of the purified liquid spillage to natural reservoirs.

The objective evaluation of sewage and purified liquid quality, their effect on natural reservoirs and their inhabitants can be done only with simultaneous use of data of chemical analysis and toxicological tests on water organisms.

Methods of work with Daphnia magna Strays, lower crustacean which are one of the most environmentally important groups of sea and freshwater organisms-plankton crustacean - were used for biotesting of initial sewage, involving heavy metal ions (Fe^{3+}, Cu^{2+}, Cr^{6+}, Cr^{3+}) and purified liquid spilled into Angara river.

Comparative evaluation of acute toxicity of sewage involving various concentrations of heavy metal ions (iron, copper and chromium) as well as corresponding purified liquids was carried out Acute toxicity determination allowed to find out dilution units "КОС-II МП УВКХ" (City of Usol'e-Sibirskoe) as well as the purified liquid spilled to Angara river.

The study of heavy metal ions effect on sewage and purified liquid toxicity was carried in four-fold reiteration in conformity with standard methods The experiments lasted 24-96 hours. Toxicity criterion was Daphnia magna Strays viability in test solutions coming in percent to control.

If during 24-48 hours 50% individuals died, the medium was considered extremely toxic; when 50% individuals died during four days the medium was considered very toxic and if they did not die even in the

undiluted liquid the latter was considered nontoxic.

Analysis of all obtained data showed that all undiluted sewage involving heavy metal ions, mg/L:

1. Fe^{3+}=0,70; Cu^{2+}=0,18; Cr^{6+}=0,29; Cr^{3+}=0,10
2. Fe^{3+}=0,94; Cu^{2+}=0,24; Cr^{6+}=0,38; Cr^{3+}=0,13
3. Fe^{3+}=1,17; Cu^{2+}=0,30; Cr^{6+}=0,48; Cr^{3+}=0,16

were extremely toxic. Runoff 1 was less toxic, as daphnia viability after 48 hours was 12,5% but in runoffs 2 and 3 100% daphnia died in similar conditions after sewage dilution their toxicity decreased thereby direct elationship between toxicity decrease and heavy metal ions presence. Thus when sewage was three times diluted daphnia death rate in runoff 1 was 60%, in runoff 2 was 70% and in runoff 3 - 80% and being twice diluted - 20%, 25% and 45% respectively.

Only purified liquid of runoff 3 was sharply toxic: daphnia mortality after 96 hours was low toxic (daphnia mortality - 20%) and runoff 1 - non-toxic (100% individual viability). Toxicity elimination for purified liquid of runoff 2 was carried out by double dilution and for runoff 3 - by four-fold dilution.

MODELING OF METHANE PRODUCTION DURING ANAEROBIC CONVERSION OF COMPLEX ORGANIC MATTER

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Microbial anaerobic processes with biogas production occurs in various habitats ranging from soil and sediments to landfills. Its may play important roles in the biological cycles and global ecology including a greenhouse effect (Zavarzin, 1986). Anaerobic digestion is one of the oldest processes used for the organic waste stabilization.

Several years passed since the generalized model "METHANE" of anaerobic degradation of complex organic matter developed (Vasiliev et al., 1993). Anaerobic degradation has been described as a multistep process of series and parallel reactions in which several key groups of bacteria take part. The development of any simulation model involves numerous simplifications concerning the process that take place in the system. The complexity of interactions in anaerobic system is very high. Nevertheless, the adequate model may help to give the general insight for the phenomena investigated. A scheme of microbial ecology is the basis of a simulation model of anaerobic process. It includes a set of variables selected (i), the defined equations involved for description of substrate limitation and inhibition (ii) and the corresponding values of model coefficients (iii).

Hydrolysis, acidogenesis, acetogenesis and methanogenesis were considered in "METHANE" model with the different kinetic functions. The hydrolysis is normally rate-limiting if the organic substrate is in particular form. Monod, Contois and first-order kinetic equations, considered with dissolved substrate traditional, have been more or less successfully tested on the anaerobic degradation of suspended solids. However, for hydrolysis process a heterogeneous reaction system, such as particulate substrate contacted with microbial cells and related enzymes must be taken into consideration (Hobson, 1987). Treating the experimental data by O'Rourke (1968); Noike et al., (1985); Shimizu et al., (1993) of suspended solids degradation the new equations of hydrolysis kinetics describing a colonization stage of hydrolytic bacteria covered the particle surface (a) and a surface degradation (b) were developed. Plate, cylinder and sphere forms of particles were assumed and relative constants were evaluated.

Using "METHANE" model for description of cellulose and manure degradation (Kotsurbenko et al., 1992; 1993) the different pathways of methane formation were analyzed at various temperature. At greater temperature (20 and 28 grad C) to acetoclastic methanogenesis occured. At ow temperature (15 and 6 grad C) the preference for acidogenesis rather than methanogenesis is observed.

Modeling of anaerobic glucose conversion (Zoetemeyer et al., 1982) it was shown that competition of butyric and propionic bacteria caused a substantial change in hydrogen partial pressure.

The necessity of Monod kinetics correction for description of methane formation from acetate at the wide range of solids retention time and acetate loading was shown treating the experimental data by Noike et al., (1985). A population shift between. Methanotrix and Methanosarcina must be taken into account introducing the kinetic constants dependent on system parameters. The allowable acetate loading was evaluated.

DIGESTED SLUDGE DEWATERING IN SLUDGE BEDS

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The microscopic examination (using an electronscan microscope) of digested sludge transported to the sludge beds of the City of Moscow revealed that the average size of soild phase particles is 3 mm; most particles have the diameter of 1 -5mm. The shape of sludge particles approximates the spherical one and the shape factor is 0.62. Experiments revealed that the location of thickened sludge layer boundary is described by the following equation:

$$H_o*(1- \frac{C_{en}}{\text{----------}})t$$

$$H_t = H_o - \frac{72}{0.018*H_o - 2.33 + t}$$

where H_o = the depth of studge bulking, C_{en} = the dry matter content in sludge transported to the sludge bed; t = time of thickening. The study of water evaporation during the process of thickened sludge natural drying gives the following equation of the process rate:

$$dHt$$

$$\frac{dm}{dt} = 0.12^{*} (1+0.69V_2)^{*}\hat{}L(kg/m^2{*}day)$$

where V_2 = wind velocity at the altitude of 2 m above the sludge surface;

$\hat{}L$ = moisture deficiency.

The study of digested sludge rheological properties during the drying process revealed that at solid phase concentration of 2-9 per cent the shearing stress depends nonlinearly on the deformation velocity. The properties of sludge of dry matter content of over 9 per cent are characteristic of viscous-plastic bodies. The water content drop from 95 per cent to 59 per cent is accompanied by the increase of structural strength by more than 3 orders (from 18 up to 48892 Pa). The critical content of solid phase in municipal wastewater sludge is 22 per cent (a sharp increase of structural strength starts when this value is exceeded).

The isothermal thermogravimetric analysis of sludges frozen and defrosted in sludge bed revealed that in this case the water content corresponding to the first critical point decreases from 92 per cent to 69 per cent. The maximum amount of free water is developed at freezing rates of 1-2 mm/h. Defrosted sludge is characterized by minimal specific resistance to filtration ($3*10^{10}$ cm/g) and maximum capillary absorption rate (115 cm/h). The investigations revealed that for digested sludges from Moscow wastewater treatment plants the most efficacious technology should include sludge separate thickening, drying and freezing in sludge beds of special design: thickening sludge beds, accumulating sludge beds and freezing& drying sludge beds. In this case the process parameters used for the sludge beds design provide maximum efficiency of these processes. According to the proposed technological concept the first stage includes sludge thickening in deep thickening sludge beds of special design. The expediency of this solution is determined by the specific features of digestion process; the efficacious application of this process requires the accumulation of sludge layer maximum depth (over 6 m) as well as efficacious drainage of supernatant water. The thickened sludge of low water content is periodically gravity discharged from drying and freezing sludge beds. The thickened sludge bulking to drying and freezing sludge beds is performed at periods most optimal for these processes. During the rest of the year (when in fact sludge watering through rainfall and snowfall takes place instead of sludge drying and freezing) the digested sludge is transported through the bottom overflow weir from thickening sludge bed to accumulating sludge bed.

The technology developed provides sludge treatment in accordance with annual natural cycle. The availability of accumulating beds simplifies the operation providing additional sludge bed space that can be used in emergency situations for mechanical dewatering. The sludge beds total loading may be factually thrice increased without any reagents and draining systems application with sludge drying up to 80 per cent; it is also possible while keeping the same loading to lower the dewatered sludge water content to 65 - 70 per cent.

The mathematical model of sludge dewatering process in sludge beds is developed based on the studies conducted; this model provides the possibility of exact calculations concerning every treatment stage as well as the possibility to operate the sludge beds based on long-term meteorological forecast and to develop the schedule for drying and disposal of watered sludges accumulated in sludge beds.

PERFECTION OF THE MECHANICAL SEPARATION AND TREATMENT OF THE SEWAGE IN THE HORIZONTAL SETTLER-STORAGE

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One of the most important problem which appear in the process of purification of sewage is the treatment of sediment. Sediments of domestic sewage, sewage of live-stock farms and some branches of food industry are biodegradable materials. The most optimal technology is dewatering till moisture content is not more than 75% and aerobic treatment.

In practice of the treatment of the live-stock farmer's sewage the horizontal settler-storage show their production potentialities very well. But as for the exploitation and regeneration in the conventional construction.

In the construction we offer you (the author's certificate is № 1711744) some packages with filter medium (straw or cowdust) installed with an opportunity of changing in the side embrasures of the body. When the level of sediment increases the filtration is through the clean, high layers of the filter medium. It doesn't reduce the rate of the filtration. Dewatering through the filtering takes place simultaneously with falling out of hard fraction, that's why a part of liquid fraction passes through the filter medium when it is light already. It increases the period filter's medium tolerance. When the settler is full of hard fraction and its moisture content is 75% the filter medium is added to hard fraction. It is done because of some reasons the correlation of carbon and nitrogen C/N is between 8-10 in sediment of sewage, but the optimal correlation of C/N for the aerobic treatment is 25-30, that's why to increase C/N the material having high C/N is added to the sediment (strow C/N is 100, cowdust C/N is 500). Along the bottom of the horizontal settler-

storage there are some perforated pipes 2 for the forced aeration. High temperature is conceded one of the most important condition for the successful aerobic treatment. As a matter of fact only some kinds of microorganisms are active when the temperature is higher than 70°C. The optimal temperature is 55°C because the processes of biodegradation and desinfection take place simultaneously. Aeration of dewatered sediment is performed according to the following scheme: 50 seconds each minutes it is continuously when the temperature is more than 55°C. As a result of the aerobic treatment the volume of the sediment is reduced half as much. It reduces the total volume of transportation. At the end of the process we have humus which is not dangerous, for surroundings. The settler is closed with a shed, which is made from a transparent material. It gives an opportunity to put an end to the places where flys and birds gather and to create temperature. When the temperature is high the viscosity of the liquor reduced considerably.

AN ADVANCED PROCESS FOR THE REMOVAL OF ARSENIC FROM EFFLUENTS

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A novel process was developed to effectively remove arsenic from wastewater and contaminated water. The process consists of three major steps: adsorption of arsenic on finely dispersed alumina, membrane filtration to separate particulates from liquid phase, and regeneration of the absorbent.

It has been demonstrated that when selected commercially available aluminas with particle sizes in a range of several microns are used and the pH of adsorption is maintained at about 3, an extremely rapid adsorption of arsenic takes place. As a result, the concentration of arsenic in the effluent can be reduced to 0.02 mg/l or less in less than five minutes.

Results of microfiltration tests revealed that a very high (more than 99,98 %) rejection of alumina particles could be achieved for commercial membranes. An effective regeneration of alumina took place in milder pH conditions, comparing to the conventional packed bed process. The regenerated alumina retained good adsorption characteristics and could subsequently be reused.

An economic model was designed for the adsorption/microfiltration process. A capital and operating cost estimate was completed at a wastewater flow of 120 US GMP (American gallons per minute) and an arsenic concentration of 3 mg/l.

A pilot scale demonstration of the adsorption/ microfiltration technology will take place in the summer of 1995. Based upon test results, recommendations will be generated for the further development and commercialization of the technology.

THE APPLICATION OF SURFACE ACTIVE SUBSTANCES IN THE PROCESS OF CHROMIUM WASTE WATER PURIFICATION

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One of ways of the intensification of the process of Chromium waste water purification in galvanic and leather production water is the development of new highly effective floculants. They intensify the function of precipitants of solution components, coagulant and hydrophobic particles of the dispersion phase.

The perspective compounds in this respect are complex cation-anion surface active substances (SAS). Under dissociation they are capable of forming two ions and bind Cr(III) both cation Cr^{+3} and CrO_2 in the wide range of pH (5-11).

In This paper flocculant capacity of anion SAS - laurat and caprilat potassium nd their analogues with organic opposite ions are studed. Cation SAS - ammonium nd pyridinium salts and also their complexes obtained ar further developed.

To flocculate Cr (III) model chromium solution on $CrCl_3$ was used. The peculiarities of flocculate capacity of the dependence on their molecular construction, concentration of solution and pH are investigated. Kinetics of waste purification under the change of their precipitation concerniry the definite period of time was studed.

The investigated compounds seem to be a perspective class for this kind of Cr (III) waste water purification. The optimal flocculant concentration is 0,5 - 5,0 mg/l for 90 - 95 % result.

One the main advantages of these investigated compounds is the high precipitation coagulant capacity in a wide range of pH (5-11).

TEHNOLOGICAL PROBLEMS OF NATURAL WATER AND WASTE WATER TREATMENT

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The problems of nature water and waste water treatment in the state is discussed. In Russian Federation is used of 111 cubic kilometers of water in a year. In general, the water is used from the surface water sources, it is so usual historically, because these water is rather cheaper.

In many cases the water quality does not meet the requirements the specifications on number of parameters, contained in it, in the cranes the water gets. There are so much reasons here.

In the result of all growing antropougenetics of effects on water surface sources, the water becomes polluted in the global: from above, from below, from fields and etc. The systems of water treatment were constructed for a long time and do not answer modern requests. It is necessary to reconstruct the treatment plants and large capital investments for these purposes are claimed.

The Federal Program on drinking water is now made. It is aimed at the decision of this problem.

There is also the Program-"Revival of the Volga River". But it is not possible to solve these programs so quickly. Ways of the gradual decision of this problem is discussed, in particular, transition to underground sources, temporarily acting of home systems are considered, which are improved the quality of drinking water are acting.

New modern methods of tertiary treatment of water are considered in report, which are offered by our scientific and foreign experts.

In the report attention to improvement of cleanliness water sources addresses, the ways of destroyed non organized discharges, diffusion of receipt are in particular scheduled and etc..

The program of gradual improvement of effluent quality of waste waters as municipal, and as industrial is scheduled. Liquidation of sludge, acting from waste water and formed at processing of drinking water, for example, and other problems are considered in detailed. These sludge are huge amount, they are harmful influence also on the water sources.

The sludge cannot be utilized for fertilizers, as the huge amount harmful ingredients is contained in it. This problem is also necessary to solve.

HIGHLY EFFICIENT TECHNOLOGY FOR BIOLOGICAL TREATMENT OF WASTEWATER USING HYDRODYNAMIC VIBRATORS (HDV)

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Treatment of activated sludge in HDV is one of the method for intensification of aeration tanks work for biological treatment of municipal and waste effluents from different industrial enterprises.

The principle of operation:

Small portion of activated sludge passes through hydrodynamic vibrator and is uniformly distributed among all the aeration tanks during the day. On pressure line of pumps one or several ultrasound vibrators working in parallel are installed.

Operating parameters:

- HDV may be using for facilities of waste water with 10ч300 thousand cub. m/day;
- oxidation capacity increases by 150ч200%;
- energy consumption on aeration is reduced by 10ч20%;
- energy required for sound generation is 2,7ч3,5% of energy required for aeration and recirculation of sludge;
- sludge index is reduced by 30ч50%;
- reduction in activated sludge growth is by 30ч50%.

Advantages:

- wide sphere of application;
- compactness;
- Increased capacity of aeration tanks without significant capital expenses;
- high removal of organic and nutrients from waste effluents;

- high specific capacity;
- improvement and stabilization of settling properties of activated sludge;
- decreased carry over of sludge from secondary clarifier;
- reduced growth of activated sludge.

This technology is protected two author certificates USSR: # 1497846 and # 1607328.

TECHNOLOGY OF COMPLETE BIOLOGICAL TREATMENT OF WASTE WATER FOR NUTRIENT REMOVAL IN MODULAR COMBINED COLUMN AND GALLERY BIOREACTORS

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The problem of eutrofication in surface water sources directly connected with nitrogen and phoshorus pollutants is still a predominant concern in most of the countries of the world. Recognizing the global and regional needs for improving for wastewater treatment, specifically in respect to nitrogen removal from inland water, the Institutes NII VODGEO and NIKTI MS, jointly have been investigated and developed new advanced and novelty environmental technologies for complete biological treatment of wastewater in modular combined column and gallery bioreactors.

The unique concepts inherent in these new technologies are based on an increase of concentration of active biomass and decrease of specific loading and oxidation rate. These concepts create and maintain more favorable conditions for the bacterial cultures during the active respiration time in the treatment system.

The increase of concentration of activated sludge is achieved due to the creation and utilization of a low energy vortex of pseudoliquified layers of activated sludge. Vortex of pseudoliquified layers are created by utilizing the energy of injected air or pumping sludge-water mixtures and recirculated flows.

The Institutes, in developing these technologies, have employed various types of engineering designs and configurations of the column and gallery types. These designs incorporate aeration tanks divided into zones of aeration and clarification by vertical and inclined partitions. The zones are hydraulically connected and include zones of degassification, recirculation and zones of suspended layers of activated sludge.

The plants, as described above, use low pressure diffused or jet aeration systems. Higher oxygen transfer efficiency and substrate utilization rate in the aeration zones of bioreactor is achieved by specific air distribution under countercurrent and cocurrent conditions, resembling the concept as employed by deep shaft aeration systems.

The results of research have demonstrated that rates of sorbtion and oxidation processes are up to twice and more as efficient as those of conventional systems.

The graphs of kinetics of the specific rates of biological nitrification and denitrification for various technological parameters are shown. These plots were developed using a municipal wastewater with no substrate addition and a retention time from 2,5 to 6 hours, including the separation time of treated water and with activated sludge ages from 5 to 43 days.

The summary results of data are based on the research and investigations of pilot and full scale treatment plant operations, collected and calculated for long period of time.

All the data are characterized, that the system operated in stable manner and at high level of efficiency in spite of variable influent characteristics, such as COD, BOD_{20}, TSS and total nitrogen, which ranged from 170 to 390 mg/l, 180 to 300 mg/l, 70 to 140 mg/l, 50 to 60 mg/l, respectively. The efficiency of treatment was at all time high producing final effluent with average values of BOD_{u}, COD, TSS, ammonia nitrogen, nitrogen of nitrites and nitrates concentrations in the range of 3,0 mg/l; 46 mg/l; 3,0 md/l; 0,3ч0,4 mg/l; 0,017ч0,02 mg/l; 0ч6 mg/l respectively.

In conclusion, it is possible to achieve the oxidation process of organic compounds and simultaneous complete biological nitrification and denitrification in the aerobic conditions, in one stage configuration, without the provision of additional substrate to the required effluent standards on nitrogen compounds.

DEEP CLEARING OF NATURAL AND WASTE WATERS ON BIOADSORBERS

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Under effect of the antropogenic factors the water of surface and underground water sources is hardly polluted by substances of an antropogenic origin (chlorine- and organophosphorus matters, detergents, pesticides, petroleum, dyes and other dangerous chemical matters). In these conditions, the existing units on water treatment do not provide drinking water of normative quality. The heaviest danger to streams represents chlorine- and organophosphorus matters, which are contained in waste waters of production of main organic synthesis, varnishes, paints, pesticides, plastic, pulp and paper industry.

Physico-chemical methods of advanced treatment - coagulation, oxidation by ozone or chlorine, the adsorption on activated carbon claim expensive and deficient reagents and equipment. The thermal regeneration of activated carbon claims a lot of energy and is connected to large losses of adsorbent. The application of reagents much increases amount of formed sludges, increases salts content treated water.

The adsorption and biological treatment are well combined among themselves at removal from water of organic pollution. They are mutually supplemented concerning types of molecules, which they are capable remove. Overlapping of biological and adsorptive stages in uniform "biophysicochemical" process lets in the heaviest degree to use advantages of adsorptive-biological cooperation and is a perspective direction of perfection of technology of biological treatment. The institute VODGEO has conducted extensive researches on development of a new biotechnological method of deep clearing of natural and waste waters - bioadsorption.

The bioadsorption process is realized in kind of a two-layers reactor, combining a zone of a fluidazed layer and a zone of filtration in a layer of granulated adsorbent. The bioadsorber has high mass transfer characteristics for effective supply by oxygen of microorganisms, stability of a media and water distribution systems against clogging, effective separation of purified water, adsorbent and suspended solids provides. The division of adsorbent into dense and fluidazed layers is carried out hydraulically in dynamic conditions by appropriate organization of distribution of water.

The natural waters much differ from waste waters by a lower level of pollution, availability mainly of refractory pollution, seasonal nature of their occurrence during of short flooding periods and low temperatures of water during winter time.

The researches of efficiency of bioadsorbers in conditions of seasonal fluctuations of water quality were executed in Moscow on Rublevskaja water treatment station during 1994 - 1995 on laboratory installations. The valuation of efficiency of bioadsorbers and scheme with the adsorption filter was conducted on reduction of turbidity, colour, oxidizability, contents of nitrogen, general bacterial number and koli-index. The efficiency also estimated on removal of specific pollution (naphthalene, biphenyl, petroleum - (C-16), lindun, simonize, carbophos, phenol, 2-4-diclorphenol, benz-a-piren).

The estimation of a barrier role of bioadsorbers was conducted twice, through 2 and 11 months of continuous work of installations. Shock feeding of pollutants carried out during 24 hours. Thus dozed: naphthalene, biphenyl, petroleum (C-16), lindun, simazin, carbophos, phenol, 2- 4 - diclorphenol, benz-a-piren in concentration appropriate approximately 100 MPC for each of them.

Conducted researches let to make the following conclusions:

The bioadsorbers with activated carbon provide intensive and deep removal of bioresistant and biodecomposed organic pollution up to parameters, not achievable by known ways of biological treatment. Due to absence of necessity of regeneration of activated carbon, this technology has essential advantages on comparison by physico-chemical treatment technologies.

Researches, conducted for the first time in world practice on real river water during two years, including winter period, but also autumn and spring floodings, have shown, that at time of treatment not more than 30 minutes, the efficiency of removal of main polluting components on bioadsorbers is practically equivalent to traditional units, including primary sedimentation, coagulation, filtration and adsorption on filters with activated carbon.

In conditions of shock loads on specific organic pollution, including petroleum, pesticides and other refractory and toxic matters, the bioadsorbers have shown higher efficiency as barrier units in comparison with the scheme, including sedimentation, coagulation, filtration and adsorption. The general removal efficiency of all components on bioadsorbers was 80-100 %, and under the traditional scheme with the adsorption filter - 45-95 %.

For the whole period of tests of laboratory installations was not observed the tendencies to decrease of efficiency of bioadsorbers. The reduction of oxidizability on bioadsorbers was equal or a little exceeds reduction efficiency of this parameter on adsorption filters with activated carbon with preliminary treatment and on the average equal about 55 %. The colour on bioadsorbers was reduced on 75-100 %, and contents Am. Nitrogen - on 82-96 %. Removal of organic pollution and ammonical nitrogen will let to reduce a doze of chlorine at the subsequent desinfection and to reduce risk of formation of toxic clororganic matters and cloramins.

PROBLEMS AND PROSPECTS OF USING ELECTROMEMBRANE METHODS FOR PROCESSING INDUSTRIAL LIQUID WASTE PRODUCTS

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One of the most important orientations of activities aimed at ensuring steady development is creating closed production cycles. Solving this problem is inseparably linked with processing and using production wastes. And the most expedient way is considered to be creating technological systems with local processing the sewage of industrial units of production, with utilizing valuable components and repeated usage of water. Solving this task is impossible without introducing basically new highly effective methods of purification into practice.

This work summarizes the results of investigation aimed at creating ecologically safe productions in chemical industry and heat power engineering.

The subject of investigation was the main wastes of technological processes of making organic products and mineral fertilizers, as well as regenerates of water desalting units. Electromembrane methods of dividing the mixtures were taken as a basis of the worked-out technologies of processing liquid waste products.

There have been considered the problems arising while applying electromembrane methods to processing multicomponent liquid wastes containing substances of organic and inorganic origin: "poisoning" of ion exchange membranes by organic substances, by ions of iron and manganese; formation of sediments on membranes; polarization of membranes, etc.

There have been proposed technical solutions enabling to exclude processes reducing the effectiveness of electromembrane processing and to broaden considerably the spheres of applying electromembrane methods.

There have been given a number of technologies of processing liquid production wastes in which, depending on the composition of admixtures and requirements to the final product, there have been used different variants of preliminary preparation of sewage and different electromembrane processes (classical electrodialysis, continuous ion exchange, electrodialysis with bipolar membranes, electrodialysis with one charge selective membranes). The worked-out technologies enable to aureate closed automated production cycles, to return valuable components, purified water and to prevent polluting the environment.

A big part of the technologies gave been introduced into production on the basis of home-made serial equipment.

The results of the research conducted show broad possibilities of electromembrane methods and effectiveness of their use for solving the tasks of protecting the natural environment.

MOSCOW DRAINAGE UTILITIES AT THE VERGE OF A NEW CENTURY

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Moscow nowadays is one of the world biggest metropolis with 13 mln population, highly developed industries, high concentration of transportation means, density built residential and public districts. Reliable and efficient operation of the drainage and waste water treatment system is one of the most important constituents of the sanitary and environmental concern of the city. Moscow drainage system which will celebrate in 1997 one hundred years is providing daily for the removal and treatment of about 6.3 mln m^3 of waste water.

The present day length of the sewerage system is about 6 000 km. Its collectors and channels have one common southward direction where the biggest waste water plants - Kuryanovo, Lyublino and Lyubertsy - are located. The waste water is pumped by 107 pumping stations.

The main problems of the drainage system are similar to the problems in other big cities, i.e. blockages, mechanical and chemical corrosion of the collectors and pressure pipelines, operation of the pumping stations in difficult geological conditions. They are solved with the help of advanced technologies (relining, protection of the inner surface, TV inspection etc.) in co-operation with military enterprises and foreign companies.

Moscow waste water plants have been designed and built following the traditional full biological treatment technology. The treatment facilities provide for the removal of suspended solids and easily oxidizable organics; however industrial pollutants are not removed. The effluent has 8-12 mg/l of SS and BOD which is better than the quality of effluents in European biggest cities.

Nowadays the institutions of Master Planning, Mosinzhproject, MosvodokanalNIIproject and Mosvodokanal have designed a Master Plan of the drainage system development up to 2010 which outlines the perspectives of building new facilities and upgrading the existing facilities.

The main idea of the drainage system Master Plan is the decentralisation of the treatment system and construction of separate small capacity facilities of 100 000 m^3/day in different districts of the city.

Before 2000 the new waste water plants (South Boutovo, Novo-Podrezkovo, Solntsevo, Scherbinka, Kourkino, Toushino) are to be put into operation. The effluent from these facilities will meet the Russian standards for fish farming water bodies.

In 1996 the 2nd stage of 500 000 m^3/day of New Lyubertsy waste water plant will be commissioned providing for the nutrients removal. The old Lyublino waste water plant will be closed since it interferes with the new built areas.

Before July 1, 1996 Mosvodokanal is holding an international tender for designing and building a waste water plant in South Boutovo with a capacity of 80 000 m^3/day. In addition, we have started designing the 3-rd stage of New Lyubersty waste water plant with a capacity of 1 000 000 m^3/day. We plan to build a plant of the 21-st century applying the advanced technologies, the economical and efficient equipment, automated and computerised.

About 30 000 t of waste water sludge is generated daily at the Moscow waste water plants. The sludge is digested, thickened and dewatered. The mechanical dewatering facilities are under capital reconstruction which envisages the transition from mineral to organic chemicals together with the introduction of high capacity chamber membrane filter presses. The reconstruction will ensure the reduction of the dewatering and transportation costs. By the year of 1998 we plan to introduce mechanical dewatering of the entire volume of sludges generated at the waste water plants.

The weakest point in sludge treatment is the final disposal. High concentration of the heavy metals in sludges accumulated at sludge beds before 1990 put certain constraints for the agricultural utilisation of sludge since it does not meet the environmental and sanitary standards. As a result the sludge is to be landfilled. The first experience will be the construction of Maryino Park on the territory of former Lyubliono sludge beds. The implementation of the project designed by MosvodokanalNIIproject Institute will provide for the reclamation of vast areas.
This is how we see the perspectives of the next 5-10 years for the Moscow drainage system to come into the 21-st century.

MEASURES REMOVING VIOLATIONS OF ECOLOGICAL BALANCE DURING DESIGNING OF DRAINAGE SYSTEMS

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Moistened and waterlogged territories with their own animal kingdom and vegetation after draining are changed considerably. Surface water goes into the drainage system from the draining territory, the level of subsoil water is reduced.

To avoid negative influences to the environment it's necessary to use the following complex of measures: soil protection, water-protection, forest-protection, anti-erosion and protection of flora and fauna.

Soil-protection measures include the preservation of organic substances, usage of the right alternation of agricultural crops and protective offorestation on crumbly sandy soil.

To avoid the erosion of the soil forest barriers are stipulated. Quarries situated on such territories can be used in fishing.

Water protecting forest barriers are projected along the water-catchers, main and other canals for protection of water resources. Moreover, during the designing of drainage systems it's necessary to make the depth of drains not more then 1.4, m, collector - 1.7 m, main canals - 2.2 m and deepened rivers - water-catcher - 2.5 m.

Forest protection measures, as a rule, include the protection of forest vegetation. The arrangement of forest barriers are provided along canals, situated along the borders of the fields of rotation of crops. They are situated on one side of the canal at a distance of 4 m from ditches with two rows of treats. Along the rivers - water-catchers forest barriers are made on both sides with width 9...12 m in borders of the water protection zone.

With the purpose of protecting fauna we shouldn't destroy trees and bushes with the help of chemical weed-killers and pesticides. Fish protecting construction complex are designed at the pump station and at the structures of the main canals. Putting fertilizer on snow is forbidden.

We should add the following measures to the previous: maximum usage of subsoil from canals and from other constructions for building of protecting dikes and embankment of roads; protection of vegetation/plant layer; the smallest losses of fertile soil for structures.

For strengthening of the process of self-purifying water goes into the water-catchers from the drained territory. A simple supported construction as a big gutter with pressure from 0.2...0.3 m is setting. This construction allows to heat the water with solar radiation and can be settled separately or together with piped cross-sections.

It's necessary to add that such constructions. In consequence of reducing the speed of flow, play the role of sedimentation-basins for catching suspended-deposits.

COLLECTOR-DRAINAGE' WATERS PURIFICATION OUT OF THE CHEMICAL POLLUTANTS

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Turkmenistan is the country of preference agricultural trend in its economy. In connection with this fact currently working one water sources (rivers, canals, collectors, underground waters) are intensively polluting: with pesticides, phenols, Sr etc. Besides waste waters. wastes of industry and agriculture affect on the quality of water sources. Application of chemical preparations for a long time have lead to the negative consequences biogenesis breach, appearance of dangerous pests and diseases, stable to the chemical agents, to accumulation of chemical poisons in the water, soil and tissues of animals.

For example let us examine collectors which are located in Geoktepinsky and Gyaursky atraps (regions). Waters in these collectors (GCD-2, GCD-3, GCD-4, GCD-5, GCWD, East, Kara-Vekil', daikhan cooperative Taze-eol) (GCD - General Collector of Drop Waters) in enough degree are polluted by DDE, which since 1970 was excluded from permitted list for application in agriculture of chemical and biological means of struggle against pests, plant disease and weeds, growth regulators of plants. In five collectors found out DL in the quantity which exceeds in 2.5 times LAC (limit admissible concentration) (LAC of DL - 0.02 mg/l). In the water of two collectors (Kara-Vekil' and daikhan cooperative Taze-eol) found out sevin in limit admissible concentrations. Especially we forced to mark that collectors of Near Kopetdag zone in progressive way from year to year are enlarged their pollution rate. CAObichr. (Chemical Absorption of Oxygen by heavy oxidizable organic substances) in all canals and collectors exceeds LAC norm except canal Gazavat. The research of many authors show that waters of Dashkhovuz Velayat (district) basically polluted with phenols, nitrates, chlorine, sulphates.

For purification of CDW (collectors drainage waters) we recommend to use several stages of purification: directly in drainage tube, in the tube of farm closed collector and in the end of between farm collector. Purification construction FDWC (filter for drainage water purification) is mounted directly on the drainage line of horizontal drainage or near the mouth of drain in the searching well and fulfilled in the kind of volume like filter. This filter includes perforated body frame with lid. Into body frame perforated glass put so that it is situated indoor on the equal distance. Filter is filled up with corn like adsorbent and with the help of quickly parting junction is connected to the drainage tube. In the end of open between farms collector we proposed to build constructions with filtration wells or sections. Loading with adsorbents is expected to be used on the period of one year with their further regeneration.

These elaborations are introduced in the projects of Turkmengiprovodkhoz. We have patents of Russia on them.

For filtration loadings we offer several kinds of adsorbents from local materials (argillite, bentonite, ceolite), which elaborated in the Desert Research Institute. Selection of adsorbents is fulfilled in accordance to the kind of the chemical pollution for given collector.

NEW TECHNOLOGY IN THE PROCESS OF SEWAGE PURIFICATION

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The goal of the work is to increase the eficiency of sewage purification works performance.

The work is being carried out by Gorvodokanal jointly with the Department N4 of the Moscow Engineering Physics Institute (MEPhI).

The present design is based on the process of purification of sewage from organic pollutions by control on content of oxygen in the air during sewage aeration. At different stages of the purification process the impact of oxygen is realized with varying intnsity.

A short-cycled adsorption plant, which operates on the principle of selective sorption of one of the components of gas mixture, is used as an air source with controlled content of oxygen. This plant operates in short-cycled regime with periodic swapping between the process of adsorption and desorption. Compared to the existing Russian and foreign analogs the plants is simple to maintain, highly reliable, low energy-intensive, and is cable of automatic operation.

The use of this technology allows to achieve the following effects:

- flexibility of control of biological purification process in earopacks and, as a consequence, increase in their performance;
- reduction of energy-intensity at the expense of decrease in mass air flow rate during aeration;
- capability, if necessary, to re-purify sewage at the cost of simple additional means;
- increase in performance of arrangements for settling stabilizing processing and plants for their dewatering.

Thus, integration of the presented technology will allow to increase the efficiency of sewage purification from organic pollutions avoiding sufficient

expenses, and to reduce total energy consumption on sewage purification on sewage purification complexes.

GALVANIC INDUSTRY WASTEWATER NEUTRALIZATION TECHNOLOGY

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The waste electrolytic solutions and the rinse waters are the main sources of the disposal of heavy metals. The first are characterized by the concentration of heavy metal's salts in the range of tens to hundreds grams per liter, the second - in the range of tenths to tens milligrams per liter. The contribution of eachsource into the total disposal is nearly equivalent. That's why the processing of them at the waste neutralization stations is done, as a rule, imultaneously.

Nowadays the large scope of technologies based on the process of the reducing of chrome (VI) compounds with the following hydrolysis is the basic mean for the decrease of the heavy metal's disposal in the galvanic industry. In the case virtually all the heavy metal's cations co-precipitate to a greater on lesser extent with the precipitates resulting under these conditions.

The efficiency of this way of purification can be judged by the following data. Reasoning from the knowledge that nearly 750.000 tons of the galvanic sludge are annually produced in RF one can state that the total heavy metal's disposal made by galvanic enterprises the comes clone to 12-20 thousand tons per year including the disposal with the waster-water (5-10 thousand tons); the total volume of wastewater approaches to 1000 million m^3.

The analysis of the neutralization stations' running leads to the conclusion that the degree of water purification in the framework of precipitation technology should gain in quality through the growth of the specific quantity of the sludge resulting when the unit volume of the wastewater is treated. But this way is seemed to be of little use because of the limited capacity of the existing sewage works and because of the absence of the mastered technologies of the processing of precipitates.

The following suggestions seem to be promising for solving these problems:

1) decrease of the entrainment of the working electrolytic solution from the bath by the work pices;

2) regeneration of the working solutions or their utilization for production of goods, e. q. pigments;

3) purification of the rinse water for it's reuse or for the utilization of the heavy metals there present.

The most characteristic lines of attack for realization of the suggestions of such kind as well as the fields of their application will be disused more fully during the report.

SULFUR IN NEW TREATMENT OF SEWAGE WATERS AND PURIFICATION OF ORGANIC SOLIDS

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From the ecological point of view, the project has no adverse environmental effect. On the contrary, the methods offered by the project are protective by nature and shall improve the general situation in the environment.

Ecobios Research & Production Company is to enjoy the rights of a project designer and is responsible together with partners for its implementation and commercial use.

The project is very well suited for local conditions as it has substandard sulfur for some of its raw material which is provided by Orenburg gas-processing plant, a subsidiary of GASPROM Joint Stock Company.

Granulated sulfur producing equipment is to be installed on its territory to bring industry as nearer to the source of raw materials as possible.

The project shall dissolve several environmental problems at once and:

- improve the quality of sewage treatment provided that available sewage works undergo reconstruction;
- protect environment against pollution by stockpiling organic solids;
- remove explosion hazard stocks of substandard sulfur at gas-processing plants.

The economic gains of the project are determined in the first place by the general environmental improvement and hence the people's health. In addition, the users of the project can profit from it

by discontinuing to pay pollution fines. Lastly, the project is quite advantageous for sulfur producers and manufacturers of equipment for granulated sulfur as their sale market expands considerable.

The new technique developed by Ecobios Research & Production Company for advanced treatment of sewage water already treated biologically make use of two-stage high-rate filters filled with lumpy or granulated sulfur. Use sulfur is regenerated microbiologically due to its peculiar features practically without traditional wasing of the filters. Such properties of sulfur can be well used in purification (mineralization) of excess activated sludge from biological sewage works with the help of special bioreactors. Thus, sulfur will make it possible to deal with two problems at one and the same project at once.

The above technique is covered by three patents of Russia. Several pilot units were installed and test-run at the sewage works of Orenburg and Astrakhan gas-processing plants in 1984-1985. And in 1986-1987 some more commercial units were designed for these plants.

To implement the project it is required to purchase some Sandvik (Sweden) granulated sulfur producing equipment and to start a commercial output of bioreactors for purification of organic solids.

Considering that at present the quality of sewage treatment almost every where does not meet modern requirements there is a great demand for the output of this project.

THE BIOTECHNOLOGY OF INDUSTRIAL SEWAGE TREATMENT

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Up to 20 percent sewage is lost in sulfur dioxide production and processing. The sewage loaded ith xenobiotics, the chemical compounds such as aminoalcohols, glycols, methanol, hydrocarbons and mercaptans, present ecological danger to the biosphere.

The traditional methods of sewage biological and physical-chemical treatment appear ineffective in this case, and therefor strong sewage is subjected to thermal neutralization or land burial, which is also far from being an optimal solution to the problem of environmental protection, preventionof marine and fresh water pollution, and of rational water management.

The biotechnology "Trofactor" is destined for effective treatment and recycling of considerable amounts of industrial sewage.

The industrial sewage carrying persistent to biological degradation organic pollutants in strong and super-strong concentrations are subject to local microbiological treatment by biocenosis of decomposer cultures, immobilized on a special contact screen, in fermenters of artificial trophic chain where the principle of spatial succession is realized. A profound renovation of industrial sewage in the final stage of the process is attainable only through application of heterotrophic cultures capable of assimilating trace organic pollutants.

The hereby offered technology of industrial sewage treatment in gas-chemical complexes comprises local treatment sewage to dispose of aminoalcohols, glycols, methanol in fermenters of artificial trophic chain.

Specialized bacterial cultures serve as decomposers of organic pollutants and as raw stuff for the production of biomass.

The degree of industrial sewage renovation over the principal pollutants is 98-99.9%. The biologically treated water may be recirculated in closed water systems of enterprises.

Trofactor plant is designed to clean sewage of gas and chemical complexes from organic pollutants of different kinds - such as alcohols, amines, glycols, mercaptans, SAS, etc.

The plant can treat sewage with concentration of organic pollutants from 20 up to 10000 mg/l. It is a universal complex in corporating a main module of microbial treatment (MMT) and an ancillary module of reagents (AMR).

The basic design elements of each MMT are anaerobic and aerobic bioreactors. Depending upon the composition of sewage and the requirements for quality of treated waste water the productivity of one MMT is 50-500 m^3/day.

The plant has been adapted to work under conditions of cold and moderate climate.

Trofactor plants can be used to treat ewage of agricultural enterprises, food enterprises, resorts and health complexes, small settlements and the like.

CONCENTRATING OF METAL IONS FROM SEWAGE WATER BY OIN FLOTATION METHOD

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Sewage water from galvanic productions contains ions of toxic metals in the amount which considerably exceeds permissible concentration limit. Therefore the problem of metal extraction is still up-to-date.

Ion flotation method is one of the promising method of separation and extraction of metals found in solution. This method is very efficient, universal and economical. Among surfactants, compounds containing hydrazide group $CONHNH_2$ may be used as possible accumulators of metal ions.

Ion flotation of small quantities of metal cations: copper, nickel, cobalt, zinc, iron (less than 100 mg/l) from aqueous solution imitating real sewage water from galvanic production has been studied using the technical mixture of compounds containing hydrazide group. To determine the optimum conditions of selective concentrating of metal ions the studies of extraction regularities of each metal depending on solution pH value and reagent doze have been carried out. Kinetic characteristics of the processes have been studied. It has been found out that extraction level in optimum conditions is about 99-100 %.

WATER AND ECOLOGY: REGIONAL COOPERATION UNDER THE AUSPICES OF THE UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

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Four decades of dialogue, negotiations and concerted action have shaped the regional cooperation on water management pursued under the auspices of the United Nations Economic Commission for Europe (UN-ECE). Work has evolved in line with the changing needs and priorities. From the earlier focus on water-quantity issues and the management of the components of the ecosystem in isolation, the emphasis shifted to a holistic approach to the environmentally sound management of inland water resources and riparian vegetation, wetlands, riverine floodplains and associated wildlife and habitats. This has resulted, for example in the 1993 ECE Guidelines on the ecosystem approach in water management, to which major contributions were made, inter alia, by experts from the Russian Federation. More attention has been given to the transboundary implications of water management as an integrated approach required planning to be based on ecosystem boundaries rather than on political or jurisdictional borders.

Soft-law instruments and legally-binding conventions.

The response of the Commission and its member Governments to the challenges of environmental protection and the sustainable use of resources has been productive in terms of declarations, strategies, and policy recommendations. The most recent recommendations or guidelines cover such issues as waste-water management, the protection of soil and aquifers against non-point source pollution, dam safety with particular emphasis on small dams, the protection of inland waters against eutrophication, the five R policies (reduction, replacement, recovery, recycling and reutilization of industrial products, residues or wastes), the ecosystem approach in water management, water-quality criteria and objectives, water pollution from hazardous substances, water-quality monitoring and assessment of transboundary rivers, specific measures to prevent, control and reduce groundwater pollution from chemical storage facilities and waste-disposal sites, and licensing waste-water discharges from point sources into transboundary waters.

These soft-law instruments were at the root of the Convention on the Protection and Use of Transboundary Watercourses and International Lakes or have been draw up to provide advice on how to implement specific provisions of this Convention. They have had a major impetus to the drawing-up of sub-regional agreements on water, such as those concluded between the Russian Federation and China, Kazakstan, Ukraine, and other countries.

The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992) is intended to strengthen national and international measures aimed at the protection and ecologically sound management of transboundary waters, both surface waters and groundwaters. In order to achieve these goals, the Parties to this Convention will be obliged, inter alia, to undertake comprehensive measures for the prevention, control and reduction of pollution of waters, particularly by hazardous substances, from point and diffuse sources. The precautionary principle and the polluter-pays principle have been recognized as

guiding principles in the implementation of such measures, together with the requirement that water management should meet the needs of the present generation without compromising the ability of future generations to meet their own needs. This will protect and conserve not only water resources but also soil, flora, fauna, air, climate, landscape and cultural heritage. The Convention also addresses such issues as monitoring, research and development, consultations, warning and alarm systems, mutual assistance, institutional arrangements, exchange and protection of information as well as its provision to the public.

The implementation of the Convention and of ECE soft-law instruments requires strengthened coordination of the water-management activities carried out in key water-related sectors within a catchment area, such as water-supply, pollution control, hydropower production, transport, industry, agriculture, fisheries and aquaculture, forestry, tourism and recreation. The involvement of private sector organizations, land owners and public-interest groups, in both the planning and implementation phases was recognized as a new task for Governments in an effort to reach a broad consensus. Governments also encouraged concerted action by policy makers, industrialists, farmers, planners, water managers, scientists and the general public.

Future priority areas

The problems and the development of response measures related to the management of transboundary waters are not unique to these waters but are common issues of integrated water management at all levels. Thus, cooperation on water under the Convention will also help countries to improve their national policies and strategies, and further harmonize them at the pan-European level. To cope with current and potential future problems, issues of future cooperation on water are expected to include the following issues: control of land-based pollution sources, sustainable water management, water and health, river and lake commis-sions, and assistance to countries in transition.

Outputs of these priority areas are expected to include: recommendations to Governments, codes of practice, guidelines and other soft-law instruments as well as methodologies; legally binding instruments, such as protocols which further specify and develop the provisions of the convention; and training courses and assistance of countries in transition in the implementation of (pilot) projects on various water management issues.

The implementation of these activities is based on major contributions at no costs by Governments, national institutions and governmentally designated experts; cooperation UNEP, WHO, WMO, FAO and the European Environmental Agency; and professional contributions by the secretariat itself.

SECTION IV
MONITORING OF WATER RESOURCES

ECWATECH

URBAN TERRITORIES UNDERGROUND WATERS MONITORING

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Geological medium of urban territories is a complex and constantly changing nature-technogene system. Intensive transformation of waters chemical composition and changes in natural interaction within the system "underground water - rock" are permanently taking place. In technogene water bearing horizons, which are being formed, certain concentrations of various chemical elements are found, which are quite unique (abnormal) for natural state of underground waters, and which are rather dangerous from the environmental position.

Ufa is the object of investigation. It is one of the largest industrial centers in Russia (petro-chemical, chemical, etc.). Recent years researches carried out in order to organize underground waters monitoring stated that underground waters here had acquired chloride-hydrocarbonate, sulphate-hydrocarbonate, sodium-calcium and calcium-sodium composition. Water type II (sulphate sodium) changes into IIIa (chlorine-magnesium) and IIIb (chlorine-calcium), underground waters mineralization being simultaneously increased from 0,4 up to 14 g/l. There are oil products (40 - 161 mg/l), phenols (up to 1 - 10 mg/l, sometimes hundreds of mg/l), dioxins (up to 18.5 mg/l), heavy metals (mg/l): copper 0.02 - 27.9, lead 0.04 - 9.4, zinc 13 - 63.6, cadmium 0.003 - 1.29, iron 420-2540, manganese 7.2 - 31, chromium 0.8 - 15.3, and others.

Neogene-quarternary rocks comprising underground waters have very high sorption properties. Capacity of their absorption complex is 43-54 mmole/100g. Two-valency actions predominate (up to 97.5 - 98.6%). Agrillaceous minerals are represented by montmorillonite group (80 - 85%).

According to nature observations and calculations data the period of contaminates presence in water-bearing horizons continues for many years and even for hundreds of years. This is connected with the fact that it requires several cycles of total water exchange to remove entirely contaminated waters out of water-bearing horizon. Duration of only one cycle in the area of active circulation in Preduralie is 10 - 20 years for intensively jointing and karst sulphatic-carbonate rocks, and up to 100 years for agrillaceous terrigenic rocks. So the process of water bearing horizons self-purification and natural state recovery is going on during scores and even hundreds of years despite of contamination source elimination, that means that it is longer than the life-time of one generation.

THE QUESTIONS ON ANALYSIS OF REMOTE OPTICAL MONITORING DATA

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It is apparent that the contact methods of ecological monitoring can't meet the modern requirements for spatio-temporal resolution and body of obtained data. Remote optical methods are quite adequate for these needs. But methods of this type finds limited use for lack of its theoretical service.

The work deals with some aspects of this problem. There are as follows:

1.) To solve the direct task of the remote optical monitoring - to calculate variations of parameters of light scattered by water, thus variations being due to ecological anomalies of water bodies.

2.) To develop the simulation models for the propagation of pollution from varied origins.

3.) To solve the reserve task of the remote optical monitoring with the use of apriori information extracted from the simulation models.

4.) To devise the algorithms for reducing errors associated with the natural noises (atmosphere, distorted water surface).

In this work the technique for making remote optical sensing of water bodies is proposed. It allows the spatio-temporal variability of water ecological parameters to determine. The results of experimental checking the devised methods are given.

MODERN OPTICAL TECHNOLOGIES IN OPERATIVE "IN SITU" ECOLOGICAL MONITORING

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Ecological monitoring of sea regions (especially, in coastal zones) can be carried out in two stages [1,2,]. The first (in situ) stage includes:

- the operative estimation of general ecological situation;

- the discovery of ecological anomalies and the study their dynamics;

- the determination of integral ecological parameters (IEP).

Usually, on this stage remote and contact sensors from quick carriers are used.

The second (in situ and in vitro) stage includes:

- the identification of pollution in discovered anomalies;

- the determination of specific pollution contents.

Traditionally, on this stage the analytical laboratory technics are used to investigate water samples.

Described two-stage ecological monitoring makes it possible to cut down time measuring and expenditures.

During last years S.I.Vavilov State optical institute remote and contact photometrical technics have been used for the operative ecological control of upper seawater layers of the Baltic Sea [2,3,4]. The reconstruction of specific concentrations of dissolved organic matters, phytoplankton pigments and total suspended materials were carried out with simple multispectral algorithms [4,5]. On the base of experimental and theoretical results it has been created the optical technology of operative complex observations of sea natural ecosystems in the places of technogenic influences [6].

Such methods make it possible to detect ecological anomalies almost in the real (on-line) regime.

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THE PRINCIPLES OF THE CREATION ON OF THE SW MONITORING AND MANAGEMENT OF THEIR RESOURCES

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SW is the part of environment and the changes in subsurface hydrosphere such as surface water, soil, vegetation, development of exogene geological processes and etc. Technogene influence on regime, resources and mainly on quality of SW increased year by year. Development of the process of exhaustion of SW resources in some foothill areas is observed, as well as pollution by fertilizers, poison chemicals, industrial water, wastes of farms and others.

The decision about management system on rational utilizing and protection of water resources from exhaustion and pollution can be taken by the State after the "Complex scheme of utilizing and protection of water resources" will be compiled. Thus, it is necessary to note their influence on other components of environment. The system analysis of various information is due to precede this decision. The analysis characterized present conditions of further directions of hydrogeological processes. This can be achieved on the scientific basis of the organization of the complex observation for SW conditions system and that means monitoring closely related with the observation for other components of environment.

In the base of searching the scientific approach it is necessary to fix the system: atmospheric precipitation-surface water-rocks-subsurface water - organic substances.

Any changes, Taken place in SW in some regions or zones may essentially affected on changes in other adjusted regions (and countries), besides, with other components of environment. Therefore, SW monitoring has to be done on the State level.

Monitoring of SW is systematic stational observation for their conditions change upon influence of natural and technogene factors, directly methodically related and organized to decide the problems of forecast and management of SW resources, regime and quality. The main problem of creation of monitoring is to receive systematically correct information, evaluation and control of subsurface hydrosphere conditions and interaction with environment to get decision management of resources, regime and quality of SW. Keeping the quality in technogene condition is very important. The State monitoring of SW can operate if the following systems simultaneously are functioning:

1.United coordination center to collect information about indexes characterized factors (native and technogene) and conditions o SW.

2.Initial processing and generation of regime observation data of SW resources.

3.Systematic calculation of SW resources, production and utilizing.

4.Evaluation of current conditions of SW and control of indexes in accordance with standards, as well as formerly carried out forecasts.

5.Regular short-term and long -term forecasts of SW conditions.

6.Preparation and operating of information data base on SW quality and quantity.

7.To provide the inquiries of the State bodies and water consumers by SW conditions and utilizing facilities.

NATIONAL STANDARD PATTERNS - THE BASE OF RELIABLE WATER MONITORING

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The Law of Russian Federation "The Measurements Unity Providing" stipulates spheres that are covered by National Metrology Control and Inspection which imply obligatory employment of National Standard Patterns (NSP) as metrology means of composition and properties measurement. One of such spheres where NSP employment is obligatory is quality indexes control of natural, potable and sewage water.

Some years ago Water Research and Control Centre (WRCC) started the work on development and mass production mastering of composition NSP for toxic organic and inorganic ingredients which content in water is regulated by national and international normative documents now in force.

By the present moment WRCC has developed and mastered mass production of wide range nomenclature of composition NSP for providing metrology means of water composition measurement. This nomenclature can be divided into several groups.

First group includes set of inorganic substances water solutions (anions and cations) composition NSP of 32 denominations, each of them includes several NSP with different concentrations of component tested. Relative error of these NSP set testing does not exceed 1,0%.

Second group includes pure organic substances NSP of seven denominations. Relative error of principal substance content testing is less than 0,1 %.

Developed and produced in WRCC NSP are radically different from known national analogues by the fact that absolute methods of analysis are developed and used for their testing. These methods are based on fundamental physical constants, reference values of physical and physico-chemical properties of substances, materials and their solutions. Testing methods that are used in WRCC does not require any other NSP for their carrying out and are materialized in working standards and standard measurement means, duly tested in metrology organisations of Gosstandard of Russian Federation.

For example, for the purpose of testing composition NSP of heavy metals ions water solutions, Working Standard for molar concentration unit of electrically active in water solutions substances "Kulon" 154-1-94 is employed. This standard is based on using fundamental electrochemical constant.

Metrological testing of pure organic substances composition NSP is carried out in WRCC on Basic Standard Installation of organic substances molar fraction unit measurement "Kriom", which employs the absolute cryomeasurement testing method based on the using of cryoscopic constants of substances.

We also can list the following other advantages of WRCC NSP in comparison with their known analogues:

- For NSP the content of admixtures, controllable by modern analytical methods tools, is standardized;
- Whereas in sets of NSP a number of various concentrations is available, it makes easier to work out calibration curves and minimizes the errors while preparing calibration and control solutions.

NSP developed and produced in WRCC are intended for calibration and providing metrology means of measurement for various kinds of water composition testers, based on modern analysis methods (photocolorimetry, photometry, liquid and atomic-absorption spectrophotometry, ionometry, liquid and gas chromatography, polarography, voltammetry, spectrometry of inductor-confined plasma, X-ray fluorescence analysis); as well as for accuracy indexes control of existing techniques of measurements fulfilling (TMF) of water and water environments composition; for metrology testing of relative TMF; for approving (authorization) of analytical laboratories (centres).

Instructions for NSP application are attached to certificates, being the integral part of NSP sets.

INFORMATION SYSTEM ON SUSTAINABLE DEVELOPMENT OF THE ARAL SEA BASIN

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The Aral Sea a unique closed water body in Central Asian region started drying up during the life span of one generation and is negatively affecting natural, social, and economic conditions of the adjacent area. In order to combine efforts on conservation and rehabilitation of the Aral Sea, on identifying joint actions to overcome the ecological crisis heads of the five Central Asian States: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan came to the agreement to undertake joint actions for solving the problems of the Aral Sea Basin.

Among major decisions within this Agreement is setting up an Information Center on socio-economic development, scientific and technological, and ecological cooperation in Ashgabat at the Desert Research Institute, Turkmenian Academy of Sciences with branches in each member-state of Interstate Council on the Aral Sea Problems.

The main objectives of this Center are:

- collection, processing, and systematizing information of ecological and socio-economic situation in the Aral Sea Basin;
- setting up a unified information basis and databank for the rational utilization of natural resources in the Aral Sea Basin;
- working out recommendations on socio-economic development, scientific and technological, and ecological cooperation of Central Asian states in solving the Aral Sea problems;
- working out the concept and program for developing a unified monitoring system of the Aral Sea environment;
- working out unified methods for ecological and economic assessment of utilizing natural resources utilization;
- working out the main principles and criteria for legal acts of Central Asian States on stabilizing and improving environment and social protection of the population.

At present the Integrated Information System on Sustainable Development is being set up so that the Center could function within the framework of UNDP in solving the Aral Sea problem.

The report will give the account of ways for solving tasks facing Central Asian States as well as the further functioning of the Integrated System.

BASIC SCIENTIFIC AND TECHNOLOGICAL PRINCIPLES FOR CREATING OF ECOLOGICAL MONITORING SYSTEM UNDER LIQUIDATION OF THE CONSEQU-ENCES OF LARGESCALE OIL SPILL IN DISASTROUS SITUATION

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In the present period in Russia the emergency oil spills were detected on a large scale. Usually there are the result of pipeline accidents. In accordance with data of Russian Federation Ministry of Fuel and Ehergetics there were more than 20.000 accidents per annum on the pipelines during 1991-1994 years (more than 24.000 accidents in 1994). Some of these accidents may be classified as ecological disasters. Among the oil ecological di-saster the same in Comi Republic is distinguihed. In process of this disaster the value of oil spill is about 14.000 ton. (by the data of joint-stock company "Comioil") or 100.000 ton. (by the data of the World Bank).

The analysis of ecological consequences for the similar disasters and analysis of processes of it liquidations lead to the following conclusions connected with monitoring system creation.

1. The ecological monitoring system (EMS) should be created in the same time when accident was discovered and the scale of ecological consequence was valued qualitatively. EMS should be projected as system for long active work after accident for some years to come.

2. EMS included the subsystem (SS) for of estimation of pollution (the quantitative characterics of pollutions, the dynamics of it transference on the territory, the forecast of oil components conduct and so on), SS for ectimation of oil pollution influence on the biota, SS of medical, senitare and social monitoring, SS for support of engineering decisions and for control of its effectiveness and so on.

3. The block of physical and chemical analysis (except tra-ditional functions) should analyze the oil components conduct in the environment (the water sulubility, the interactions with ground, bottom sediments, the possibility of filtration ets), analyze the oil photochemical reactions and oxidation during long oil being on the territory. The chemical transformations of oil components should be accounted when the temporary standarts of oil concentrations (on the ground, in the water, ets be created. In the some time this block should analyze the pollutions from stratum water, what usually

accompanies the oil transportation and analyze air when oil is burned, including the dioxin determination.

4. The systematic using of aerospace observation is very useful for EMS connected with the oil spill. Automated instru-ments for early notice of oil break through dike, floating barriers and so on is very important too.

5. EMS should control periodicaly or systematicaly the efficiency of engeeniring protective constructions against oil and control the ecological safety of stores for collected oil.

6. During process of investigations of oil pollution influence on the biota, the agricultural plants and animals are separated in special group for first step of analysis. In framework of bioecocenosis the *indicator organizmes should be determined.*

7. Social monitoring (in framework of EMS) including the collection and processing of data complex on the demographical, social, medical, sanitary, ets aspects, what characterize the quality of life, and the level of population health. The social in-vestigations may be accompanied by psychological "unloading" of population for limitation of development of "mass horror", what was produced by psychical action of ecological situation on the population.

8. The data base (DB) should form as united DB for all organizations, which work in disastrous zone. It's necessary to create the DB on the base of GIS-technologies. The forecasting models, management decision, economical calculations ets were made with using of this DB.

The data subbase about ecological situations before disaster should be created as the bilding block for analisis of dynamics of ecological process on the territory. The expirience from the similar disasters shows, that it should be recomended to create the subDB (SDB) (about ecological situation before disaster) on the all territories where oil pipeline were placed. These SDB sho-uld be created by *territorial environmental protection organizations or* nature protection departaments of oil companies. These SDB include data about hydrology of rivers, characteristics of soil, underground water, biota ets ("The normal standard of territory with high ecological risk"). SDB should include also the oil parametrs which needs in disastrous situation (water sulubility, activity for sorption on the soil, bottom sediments, river ice and so on ("The ecological standart of oil and oil products").

NEW APPOROACHES TO BIOTEST OF WATER QUALITY

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The multicomponent chemical pollution is typical for Russian water. In many cases the total effect of it influence on the biota are delermined by synergism (as rule, there are strengthening toxical action of one component on other). It's the problem for total effect calculation on the base of Limiting Pezmissibe Concentration (LPC) for toxicants. It should be added that LPS are unknown for many chemical substances. There and others circumstances make the using of biodetectors and indicator organismes as necessary technology. But in this case the principle methodological problem is associated with data extrapolation from bioindicator level on the level of more complicated biological organizmes (man, for example). New system of toxical classification was proposed. It based on the using of complex of living cell characteristics. The practical methods for this technology realization was proposed too.

THE ELABORATION OF ENVIRONMENTAL MONITORING SYSTEM FOR THE BASINS OF THE TEREK AND THE SULAK RIVERS AND ZONE OF THE CASPIAN SEA

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The very negative ecological situation on the North Cauca-sus is obsorved in the basins of the Terek and the Sulak rivers and in the mouth zones of these rivers in the Western part of the Caspian Sea. In whole, it's connected with general hard economics conditions in industry, agricultural and municipal economy in Russia and with known events in Chechen Republic. In particular, the important role belongs to water pollutions, which are gene-rated by slimes of leaden, tungsten and molibdenum production and by intensive oil water pollution from Chechen Republic. The real menace for irrigated agricultural fields and for generation of unique fishy resources of Western part of the Caspian Sea arised. The danger of negative influence on the population health incre-ased. These data were confirmed by selective ecological investi-gations

during summer of 1996 under the guidance of this report authors.

The project of environmental monitoring system (EMS) was created for ecological situation optimization. The system was design as part of United State Ecological Monitoring System in Russia. EMS consists the subsystem for data collection, including the net of the sampling of water and net of analytical laboratories, subsystem for data collection and treatment (on the base of GIS-technology), subsystem for forecast models, economics calculations and preparation the management decisions, subsystem for reference data and so on.

The flow of information was organized on the base of internalrepublic blockes for each of 5 republics of the North Caucasus. Inside of block all environmental protection and natural resources management organizations of republic level send the information to republic goverment body for water management. The last send the information (after processing) to Western-Caspian Basin Water Management Administration.

The project foreseed the common methodology for data collec-tion and processing, the united forms for informative exchanges the common system of GIS-technologies and so on.

The monitoring system project also supposed the crealion of automated subsystem of early notice of oil spill on the water objects (this system was designed together with Russian Federal Nuclear Center).

Several directives and standart papers were pablished on the republic and interrepublic levels for EMS creation.

MONITORING OF THE LITTORAL ZONE OF THE CASPIAN SEA IN THE RUSSIAN FEDERATION ON THE BASIC OF THE REMOTE SENSING METHODS APPLICATION

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The Russia Institute for Land and Ecosystem Monitoring has been carrying out investigations on the estimation of the land conditions and the negative processes development in the delta of the Volga since 1992.

The territory of the delta of the Volga is a unique natural system. Coastal waters are attributed to the category of lands of international significance as a place of birds inhabitance. Here are 3 big ecosystems:

- arid, semidesert, zonal territories;
- meadow-bog soils of the high-water bed and the delta of the Volga;
- defined area of the Volga and Caspian Sea water.

The landscape of the delta of the Volga is characterizes by a complexity of soils and plan cover in combination with the semidesert, forest, shrub, meadow, water vegetation on brown, alluvial meadow, alluvial meadow-bog, estuary soddy soils of different mechanical composition. Soils are salinized in some places. The depth of the graundwater surface bedding on the hillocks is superior to 3.0-5.0 m, it varies from 2.0-3.0 m to 0.0-0.5 m on the rest of the territory. Water has different degree of mineralization. Fresh and strongly mineralized in some places, the total solids content is from 5-20 g/l till 30 g/l.

The ecosystem condition of the delta and the Caspian Sea is determined by the biggest European river - the Volga - with an annual average runoff of 241 cubic . The delta is a pollution accumulator because of its subordinate position relative to the other landscapes. The intensive development of industry, agriculture, a high population density of littoral area of the Volga caused a very high population degree of the northern part of the Caspian Sea and the ecosystems of the delta of the Volga.

An important factor influencing an unfavorable ecological in the delta is a continuing level raising of the Caspian Sea.

The Caspian Sea is a unique intercontinental reservoir of the Earth, that as a sensitive psychometer indicates the water balance change of out continents. This large sea without outflow is a big continental depression below world ocean level by 27 m, Sea area is more than 378 ht., sq., km, that makes up about 18% of all the lakes in the world.

The sea level rise since 1978 was a result of the significant climatic regime change that determines changing of circulation epochs (latitudinak rise and meridional reduction repeatability). The climatic regime change was accompanied by the cyclonic activity increase (by 12%), cyclonic water quantite rise till 35%, cloudiness and precipitations rise, sea water temperature decrease and surface evaporation reduction.

In 1992-1995 work on estimation and mapping of land flooding and underflood in Astrakhan region including the delta of the Volga was carried out by the Russia Institute for Land and Ecosystem Monitoring.

The space spectrozonal images on the scale of 1:100000 in the visible band, space scanner images with the resolution of 45 m, ground data of the underground water level and their mineralization degree were used for the estimation and mapping of the land condition dynamics of the coastal zone of the Caspian Sea in the area of the delta of the Volga.

A hydrological regime network of slits was arranged in three sites in order to determine an underground water level in the coast zone. The underground water level between the slits was determined by the electric sounding.

Land flooding and underflood as caused by two factors: natural and technogene. The main natural factors are: flood, high-flood, sea level raising. During the last years the Caspian Sea level raising caused flooding of the flat modern sea plain and of the slope-crest part of the maritime delta till and absolute elevation - 26.6 m This process is a progressive one. By 2010 it is forecasted land flooding till an absolute elevation - 25.0 m

Data analysis of the land flooding and underflooding development in the delta of the Volga because of the Caspian Sea level raising showed that the total land underflood area in the delta of the Volga within the Astrakhan region made up near 1 million ha in 1995.

In 1992 a considerable flooding boundary advance was remarked on the territory of the low shallow delta plain with absolute elevations - 26.5-25 m and less.

A very strong progressive natural underflood is in the area of the maritime slope-crest delta, that is a zone of groundwater afflux by the sea. Here in the lowering of the relic bays and estuaries the groundwaters rise till the depth of 0.0-0.5 m and on the near river bed boulders and spits till 0.5-1.0 m.

The high islands in the delta of the Volga and the presence of the new Caspian plain features within its boundaries have different combinations of natural-technogene land underflood: from a small (a groundwater level rise 1.5-2.0 m) till a strong one (groundwater level rise 0.0-1.0 m).

The experiments allowed to distinguish the main land underflood and flooding types of the Astrakhan region and the delta of the Volga:

- a progressive flooding and underflood connected with the Caspian Sea level rise;
- a natural-technogene underflood from a small till a strong one;
- a possible natural-technogene underflood;
- a periodical flooding connected with flood spring flood;
- a stable and a periodical technogene flooding;

and to draw up maps of the land flooding and underflood of the Astrakhan region on the scale of 1:200000 and the Kamyzyek region on the scale of 1:50000.

DEVELOPMENT OF MULTIPARAMETRIC OPTICAL ASSAY FOR ON-LINE WATER CONTROL

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Natural water could be considered as polycomponent polymodal biomineral disperse system. Nowadays fundamental study of such complex water systems is very actual.

Simultaneous Multuparametric Optical Assay (MOA) can provide on-line information about disperse system state. It is connected with fiber optics development, and it seems available not only for systems with different nature of particles, but also for particles with complex internal structure.

Modern technologies of data interpretation from different optical methods such as: refractometry, absorbance, fluorescence, light scattering (integral and differential, static and dynamic, unpolarized and polarized) allow to classify disperse systems. So for unknown multicomponent disperse system, for example, industrial waste water with organic and mineral particles or with impurities of metals or oil, the analysis of measured parameters can help us to identify the unknown system components. Even the slight shift of known system state due to changing of physico-chemical conditions can be registered by MOA.

Now we are developing the structure of MOA information base - Bank of Optical Data for Disperse Systems (BODDS). The goal of BODDS is computer processing of disperse systems analysis, systematization, interpretation and statistic study of data.

The creation of BODDS is directed towards the increased knowledge and understanding of optical parameters changing under processes in complex water disperse systems, i.e. aggregation, sedimentation, coalescence, flocculation, geteroaggregation, fractal aggregation, etc.

In future BODDS can develop into International interdisciplinary as the disperse systems fundamental investigations as the Department of Technopolicy in Lesnoye which is planned in St.Petersburg State Technical University with participation of Physico-Technical Institute named by A.F.Ioffe Russian Academy of Sciences (RAS) and Institute of Cytology (RAS).

ANALYTICAL POSSIBILITIES OF MONITORING OF HEAVY AND TOXICAL METALS IN WATERS AND DRAINS BY MEANS OF ICP/ECHELLESPECTROMETERS PS SERIES LEEMAN LABS INC (USA)

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Leeman Labs Inc. (USA) produces wide spectrum of analysers for quantitative analysis of materials especially ICP-spectrometers: sequential (PS1000), simultaneous (PS2000), combined (PS3000) with axial (horizontally-viewed) and radial (vertically-viewed) plasmas and also mobile (PS1000M).

Produced ICP-spectrometers are used for analysis of aqueous, acidic, alkaline, organic solutions on amount of 71 elements with detection limits 10^{-5}-10^{-7} % on most elements. They allow to analyse different substances and alloys, raw materials and finished production, soils and rocks, food and biological preparations, oils and oil-products, waters of different origins, acids and alkalies, aerosols in air and other gases.

Those instruments are ideal suitable for ecological monitoring of environmental objects. Just Leeman Labs instruments had wide applications in activities of Environmental Protection Agency (EPA) USA.

Distinctive features of ICP-spectrometers PS series:

- thanks to using echelle grating instruments provide most outstanding resolution and dispersion among famous ICP-spectrometers ("Leeman Labs Inc" was first company in world which used echelle grating in ICP-spectrometers more than 10 years ago);
- high spectral resolution of ICP analysers allows to minimise the spectral interferences and matrix effects;
- application of fixed diffraction grating in combination with prism for separation of different order lines and two-dimensional system of exit slits (up to 500 spectral lines), provides the fast and exact movement of detector from one analytical line to another without additional wasting of time on peaks search;
- the application of two independent systems of analysed samples introduction into the plasma allows practically completely to eliminate the waste of time usually spent on washing of introduction system and nebuliser; as the result the sequential spectrometer PS1000 allows to analyse in one hour 42 samples on 18 elements, thus providing the 30% better productivity than traditional multyhannal spectrometer with single sample introduction system.

Table.The main technical characteristics of ICP spectrometer, spectral resolution/dispersion.

wave length, nm	spectral resolution, nm	dispersion nm\mm
200	0.009	0.083
400	0.016	0.137
600	0.023	0.200
800	0.030	0.270

Analytical possibilities of "Leeman Labs Inc." analysers will be demonstrated on series of practical examples of heavy and toxic elements determination in waters and wastes of various origin.

Table.Limits of detection for axial spectrometer.

	ppb (or x10^{-7}%)	EPA regulations
Ag	0.6	10
Al	1.9	200
As	3.8	10
Ba	0.12	200
Be	0.09	5
Ca	0.2	5000
Cd	0.2	5
Co	0.8	50
Cr	0.4	10
Cu	0.7	25
Fe	0.5	100
K	5.0	5000

	ppb (or $x10^{-7}$%)	EPA regulations
Mg	0.03	5000
Mn	0.07	15
Na	2.2	5000
Ni	1.6	40
Pb	1.6	3
Sb	2.6	60
Se	3.8	5
Ta	4.8	10
V	0.4	50
Zn	0.4	20

THE USE OF THE "IVA" SERIES STRIPPING VOLTAMMETRIC ANALYZERS FOR ENVIRONMENTAL MONITORING

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We offer "IVA" stripping voltammetric analyzers, which serve to determine concentrations of toxic elements in nature. The "IVA" analyzers (Specs TY-4215-001-05828695-95) have been designed and put to a large-scale production by the "IVA" LTD and the Ural Special Design Bureau of Metrology (Ekaterinburg). The Certificate No.2069 has been entered in the State Register of measurement means on February 20, 1996 and assigned No.15168-96.

The "IVA" stripping voltammetric analyzers are made up of: a universal electronic unit, a magnetic stirrer, a three-electrode elecrochemical cell with a set of electrodes, a package of certified methods for quantitative determination of ions of heavy metals. The analytical signal (response) is sent either to an X-Y recorder or to a computer. The relevant software is supplied with the analyzers.

The main characteristics of the instrument are as follows:

- concentrations determined 0,5-2000 ug/l
- relative error 10%
- analysis time 15-45 min
- power supply 220 V a.c., 50 Hz
- power consumption 60 W
- overall dimensions 360 x 310 x 140 mm
- dimensions of the recorder 480x440x110mm
- sample volume per analysis 1-10 ml

At present we have at our disposal certified methods for determination of mass concentration of copper, lead, cadmium, zinc, chromium and nickel ions in natural, drinking and waste waters. Other certified methods can be applied to determine mass concentration of copper, lead, cadmium, zinc and tin ions in foodstuffs and foodstuff original products.

Solid-phase electrodes are used as the sensors in the "IVA" analyzers:

- reusable impregnated carbon-containing electrodes (EGI-1),
- disposable composite carbon-containing thick-film electrodes,
- long-living electrodes with renewable surface.

The use of the last electrodes permits automating the measurement process and omitting the stage of mechanical treatment and renewal of the surface.

The main features of the "IVA" analyzers that distinguish them from analogous voltammetrnic devices and the PU-1 polarograph are as follows:

- metallic mercury is not needed,
- the surface of solid-phase sensors is regenerated electrochemically,
- the analysis algorithms used to determine the concentration of copper, lead, cadmium, zinc, chromium, nickel, tin, selenium, manganese, tungsten, molybdenum, etc. ions do not require removal of dissolved oxygen.

The interference of organic components is eliminated by:

- electrochemical pre-treatment (the "IVA" analyzers has a built-un sample pre-treatment unit),
- chemical ashing (a chemical decomposition unit (USA) is optional.

The remote field monitoring can be realised with the help of an automated flow-through analyzer capable of long-time independent and unattendant operation. The software of the flow-through analyzer analyses the current conditions and makes decisions on exceeding the maximum permissible concentrations of noxious substances. A self-calibration system is provide to ensure stability of characteristics throughout the operation time. When connected to electronic communication lines, the analyzer can function as the basic component of an ecological monitoring network. The use of a long-living self-renewable working electrode largely extends the continuous life of the flow-through analyser: consumable materials can be replenished once every 2 or 3 weeks. The use of the "IVA" stripping voltammetric analyzers is economically sound, providing a satisfactory cost/profit ratio.

MONITORING OF MUTAGENICITY AND GENOTOXICITY OF WATER ENVIRONMENT IN THE WATERBODIES WITH COMMERCIAL FISHERIES

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The pollution of waterbodies by many chemical substances of anthropogenic origin requires simple and reliable methods for testing genetic danger present in natural waters, sediments, tissues of hydrobionts and some representatives of pollutants, in their complex mixtures and metabolites contained in sewage waters which contaminate waterbodies with fisheries.

Different classes and mixtures of pollutants may bring about genic, chromosomic and genomic mutations, so a test battery is needed to reveal all kinds of mutations. Such a set of assays has been developed and approved in AzNIIRKH, in the laboratory of genetic and biochemical monitoring in 1989-1995, with some aqueous test-objects included in the set.

The Aims test on Salmonella typhimurium was used to reveal genic mutations. The indicator strains TA98 and TA 97A auxotrophic according to hystidine revert to the prototrophity during mutations of the "frameshift" type, while the strain TA100 reverts during mutations of the type "substitution of base pairs". These strains were used with metabolic activation when a microsomal fraction was added and also without activation.

Meristematic cells of sprouts of onion Allium cepa and of the epithelium of fin edge of prelarvae of Russian sturgeon Acipenser guldenstadti were employed to induce chromosome aberrations. The anaphase method was used to count "bridges" and fragments of chromosomes. In all the cases the mitotic index was taken into account which allowed one to judge about the genotoxicity of the substances tested.

To allow for the anomalies in vivo of nucleus apparatus, the frequency of formation of micronuclei and the damage of the nucleus apparatus in the erythrocytes of two abundant Black Sea fish species Gobius platyrostris and Grenilabris ocellatus have been studied. This method is very sensitive. Genomic mutations were revealed by the teratologic analysis of sturgeon larvae under laboratory conditions and of round goby Neogobius melanostomus under natural conditions in the Azov Sea.

These methods of monitoring the mutagenicity and genotoxicity have been tested on pollutants of different kinds: chlororganic pesticides, polyaromatic compounds, heavy metals, detergents, four fractions of mineral oil products, sewage waters of aniline industry. This complex of methods is used in the monitoring of natural waters and sediments of fishery waterbodies in the Black and Azov Sea Basin and of different marine products as well.

A valuable approach is the use of biological "indicators" of the accumulation of pollutants. We used for this purpose the following bivalves: Unio sp. and Anodonta sp. in fresh waters and mussel Mytilus galoprovincialis in the sea. The analysis of mutagenicity of extracts from tissues of these species provides data on the total mutagenicity background in the waterbody being tested.

These methods are simple enough and have been verified. They are characterized by high sensitivity and reliability in determining the level of genetic threat in water.

AUTONOMOUS MULTI-PURPOSE STATIONS "STAM", "MES-1", "MES-2" FOR NATURE ENVIRONMENTS MONITORING

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General function of these stations is multipurpose nature environments monitoring in gas-gas-condense- and oil- deposits areas in the Far North and neighboring regions.

"STAM" - all-seasons multi-purpose nature environments monitoring station - is intended for explorations and forecasting technogenic pollution and natural or antropogenic emergency situations in above-mentioned regions by abundance of lakes, marshes, small rivers and in the caostal regions.

On-board equipment complex of "STAM" station include:

- Hydrochemical complex;
- Gas-analytical system;
- Meteo-physical automatic system;
- On-board computer;
- Water-and bottom ground samplers;
- Accessory equipment.

"MES-1", "MES-2" - all-seasons mobile ecological stations -j are intended for water, snow, ground pollution express-analyses for heavy metals and organic compounds contents with the purpose of exposure and forecasting of emergency situations in the Far North.

On-board equipment complex of "MES" stations include:

- Automatic express-analyzer of water, snow, ground pollution with managing computer, monitor and portable printer;
- Automatic hydrophysical system;
- Accessory equipment;
- Autonomous energy supply set.

On board equipment complex have metrology certificate N №2420/20-96/0018, issued 16.01.1996.

Mobile stations "STAM" and "MES" vehicles can be used any time of day and night and ant seasons in the lack of roads. They can move over tundra, not damaging its cover, over marches, virgin snow, over water space (rivers, lakes, independently of water depths).

Stations have autonomous energy supply, they can be used in isolation from bases and energy supplies up to 400 km.

MONITORING OF THE TECHNOGENIC LOAD IN THE OFF-SHORE AREA OF THE BLACK SEA BASED ON AN ANALYSIS OF THE VARIABILITY OF THE SHAPE OF MUSSEL (MYTILUS GALLOPROVINCIALIS LAM) SHELLS

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The Mediterranean mussel is a unique object which provides a very broad range of possibilities for ecological monitoring of the off-shore area of the Black Sea. It is a wide-spread species, its abundance is high, it is readily accessible for studies, it is characterized by combination of the settled and the plankton period of life, by its ability to accumulate pollutants, by eurybiontic nature and it exhibits a high level of polymorphism - this is a still incomplete enumeration of the distinguishing features of this species which make it one of the best test objects in the Black Sea.

So as to reveal morphological peculiarities in the mussel shells which could serve as indicators characterizing the environment, 15 samples of mussels have been studied collected in the off-shore area of the Black Sea from the Kerch Stralts to the town of Tuapse which constitutes two thirds of the Russian Black Sea shore line. A system of sample measurements was used to compare the shells of the mussels from different areas. These measurements covered six proportional sections and produced values for the length, convexity and the hight of the shells. All these data were transformed into indices which characterized each feature in percents relative to the length of the mussel.

The starting data have been analyzed by the discriminant method. It has been shown that the samples under study form 3 specific groups both in regard to mathematical expectation and to the magnitude of dispersion. The first group comprised the mussels from the Tsemess Bay (Novorossiisk) and from the sea near the town of Tuapse, they were taken right from the port areas. The second group was represented by the mussels from the village of Kabardinka on the easte end of the Tsemess Bay about 8 km from the port area. The second group included also samples from the areas of small ports on the Blue Bay (Gelendjik) and Great Utrish. The third group contained mussels from recreation areas without any port facilities. The differences between the groups are statistically highly reliable ($P<0.0001$).

The character of the position of groups in the space of the discriminant function has allowed one to reveal an obvious dependence of the shape of the mussel shells on the level of the anthropogenic effect, rather on its technogenic component. Evidently the first group was subject to a high degree of technogenic load caused by activities of big ports (Novorossiisk, Tuapse). The second group experienced medium level of the action of the same factors due to relative remoteness from a big port (Kabardinka) or to the fact that the ports are not big (Blue Bay, Great Utrish). The third group did not undergo any technogenic load since these mussels inhabited recreational zones.

The distribution of the specific features which were analyzed in a summary manner by all the samples shows that there occurs a continual change. The formation of this change takes place throughout the whole life of mussels. Therefore in order to update the information, observations once a year are sufficient which take into account the condition of new generations of the mussels. Thus, the morphological peculiarities in the mussel shells represent their features which are formed during a long period, vary continuously and are conservative. They are a desirable object for ecological monitoring because they make it possible not only to reveal the effects of technogenic character but also to obtain a generalized picture of this effect on the off-shore biotopes. A high level of formalization of estimates or technological load is ensured by employing equations of discriminant functions as well as parameters of the distribution of morphometric indices.

METHODOLOGICAL BASIS OF ECOLOGICAL MONITORING OF RESERVOIRS AT HYDROPOWER PLANTS

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The types of reservoirs at the hydro developments in Russia are given depending on their parameters, peculiarities of natural conditions of their location and the extent of economic development of the region. The processes having the tendency to jeopardize the situation are singled out for each type of reservoirs having an impact on the environment. Due consideration is given to possible consequences of the extreme conditions. The necessity to take the dangerous tendency under control by organization of ecological monitoring has been justified here.

The proposed system of monitoring consists in the following:

- observation for interaction of the reservoir and environment, analysis of the results of observations;
- assessment of the state-of-the art;
- forecasts of the development of the situation;
- preparation of the governing decisions for maintaining the structure in an optimal operation condition.

The monitoring consists of hydrological, hydrochemical, hydrobiological, sanitary-hygienic and parasitological, landscape, geological, hydrogeological observations and researches, control for the conditions of soil-vegetation cover and fauna.

The requirements are determined to the location network of monitoring, the composition, periodicity, methods of observations, the sets of indicators. The methods of evaluation of the situation, forecasts of its further development, preparation of governing solution, nature-conservation measures are recommended.

The ecological monitoring organized in the area of the Katun hydroplant construction in Gorny Altai and the operation Zagorsk pump storage plant in the Moscow region are shown in the paper as an example of such monitoring.

GROUND WATER MONITORING IN THE AREA OF CONTACT OF THE URALS AND WESTERN SIBERIA

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In the zone of contact of fold-mountain Urals and Westrern-Siberian artesian basin, there are large industrial centres, economy and drink water supply of which is practically based on underground waters. Experience of many years of underground water deposits usage (towns of Kamensk-Uralsky, Bogdanovich, Serov) has shown that intake structures are operating practically permanently.

Forecast assessments carried out by methods of mathematic modelling prove that the amount of withdrawal of water can be increased 1.5- 2 times. Productive water-bearing horizons are well enough protected from a surface technogenic pollution. Alongside with this, there exists (or there are forecasts of) problems as to deterioration of water quality as a result of a "natural" pollution.

In the central part of the region, deposits of underground waters are confined to regionally persistent strips of carboniferous limestones which are overlapped by thick (up to 40 m) series of argellacious Mesazoic-Cenozoic deposits. An argellacious covering bed contains a substantial amount of sulphide minerals - marcasite, pyrite and others.

In the process of a 25-year use of the Poldnevsky withdrawal of water and discharge of the Poldnevsky quarry in the area of their hydrodynamic influence there have been formed a thick (more than 30m) technogenic zone of aeration, the type of water has been changed from a hydrocarbonaceous magnesium-calcic one into a sulphide-hydrocarbonaceous one; salination of water has been increased almost two times , concentration of a sulphate-ion has been raised by a factor of 10 to the second degree; hardness of water has been increased 1.5-2 times, and exceeded maximum permissible concentration. The situation at other deposits is similar.

Sulphide minerals in drained, as the result of withdrawal of water, part of the overlying bed, are oxidized under the action of oxygen in the air and infiltrating water (in the presence of sulphate-reducing bacteria). As a result, there are formed acid sulphate waters containing higher concentrations of iron, copper, zinc, nickel, cobalt. Activization of processes of carbonaceous strata dissolution leads to leaching of calcium and magnesium from lime-

stones, higher concentrations of the hydrocarbonate-ion and hardness of water. Heavy metals form precipitating, hardly soluble carbonate complexes , as a result, concentration of heavy metals in underground water does not exceed standards.

Study of covering argellacious beds and technogenic zones of aeration has not been carried out and is not carried out during prospecting, valuation of reserves and regime observations (and later on, monitoring), at any of deposits.

The way out of a seemingly hopeless situation, considering an extremely irregular vertical sulphidization of overlying beds (content of sulphides is maximum in the lower part of of overlying beds) is in changing schemes of water intake (intake structures in different places), reducing the amount of water intake (revaluation of operating deposits reserves use). Naturally, under such conditions, requirements to the accuracy of geofiltration forecasts are sharply increased; all the engineering development of methods and regime of water withdrawal must be based on a thorough geochemical and biogeochemical study of covering beds, a technogenic zone of aeration and the very water-bearing horizon (with a quantitative description of geochemical processes in the system of an aeration zone - water-bearing horizon).

Other problems exist in the area of a contact of the North Urals with Western-Siberian artesian basin (a group of Serov deposits). Deposits of underground waters are confined here to a multilayer system of hydraulically combined water-bearing horizons - Paleozoic (jointy serpentinites), Late Cretaceous (sands and sandstones), and Early Eocene (opokas) ones.

The Serov-town experiences an acute shortage of potable water; however, productivity of operating intake structures can be substantially increased (assessments have been made using a permanently operating model of the Serov-town). However, even at present there are problems (or, in accordance with forecasts, there will be problems in the nearest future), caused by deterioration of quality of water withdrawn as a result of "natural" pollution. Thus, at the Zamaraisky deposit of underground waters and in water of drainage wells of the Serovsky nickel quarry, as the result of the increased speed of leaching of borosilicates and evacuation of boron from iron leguminous-conglomeratic ores, ubiquitously developed in the Higher Cretacious horizon, concentration of the boron ion in withdrawn ultra-fresh water conforms sanitary standards or exceeds them. At the Yelovsky deposit, according to forecasts, there is a danger of inflow of coloured (with a high content of organic substances) waters from the valley of the Sosva river.

Existing systems of underground water monitoring , inherited in general and as to their ideology and methods of realization from the previous system of regime observations , do not take into consideration peculiarities of a "natural" pollution given above, and are only aimed at fixing ground water levels and its chemical composition.

As regards the realization of monitoring, the regulation of a regime observation has to be revised, considering that at the majority of existing deposits, there are no problems with providing the necessary amount of withdrawn water, but the problem of providing water quality conforming to the exisiting standards is acute.

IMPACT MONITORING OF THE INTOXICATION OF WATERBODIES AFFECTED BY AERIAL CHEMICAL TREATMENT OF FLOODPLAIN FORESTS; SOME REGULATION MEASURES AGAINST POLLUTION

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The practice of using pesticides in floodplains should take into account a complex of measures that could smooth over negative effect on water biocenoses.

In this case a system of permissible levels of loads on the biota is necessary because it would allow one to consider the parameters of the use of chemicals (per 1 hectare) with the aim of a maximal reduction of the toxical action.

The impact monitoring of the pesticide intoxication of the waterbodies affected by aerial chemical protection of floodplain forests has been performed for the river Sev. Donets from 1977 to 1995. Experiments with insecticides were carried out in floodplains of the Ust-Donetsk and Kamensk forestries of the Rostov region. Planes of AN-2 type were used in the work.

The choice of regions was dictated by the ecological interaction of water and forest biocenoses, the expediency of preserving the floodplain forests in good condition which constitute a natural protection of water sources.

During the observation of the water regions a special attention was paid to the methods of obtaining material of high informative value. Combination of biotests and enzymatic indices with physicochemical methods seemed to be the most effective. The biological indices were selected with regard to the specificity of all the links of the trophic chain in the waterbodies, and a number of definitions adopted in the biomonitoring of natural waters was used. Data including the materials of field surveys and the results of the estimation made in the laboratory was a safe informational basis for the cont-

rolled use of more that 20 widely used insecticides, among them pyrethroids: Karate, Sherpa, Mavrik, Sumi-alfa, Bulldock, Ripcord, Fastac and Decis.

The system of regulation of pesticides based on the criteria of admissible levels of pesticide application per 1 hectare may help work out objective norms for fisheries, explain the interaction of technological parameters, the level of effectiveness and degree of ecological safety for waterbodies with fisheries.

The recommendations were effective in preventing pesticide pollution of waterbodies in the regions where the above-mentioned preparations were used.

SOME ASPECTS OF SYSTEM OF OBSERVATION PERFECTION ENTERING THE ECOLOGICAL MONITORING (FOLLOWING THE EXAMPLE OF THE REPUBLIC OF BASHKORTOSTAN)

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On the basis of methodical issues analysis in the system of observation organization entering the ecological monitoring in different regions of the Russian Federation one case easily trace great contradictions. It makes difficult to adequately assess the changes in the natural complexes and correspondingly and optimally manage the process of environment utilization and preservation. For instance, there exists great difference in methodical approach between the Institute of Applied Ecology Problems and Bashgydromet Association. The former makes Data Base on the environment condition, water resources included, by compiling and generalizing information provided by different industrial enterprises and departments.

The latter continues traditional system of observation using the surviving network of points and stations. So, both great faults in the information supplied by different departments and crucial deficiency of observation points on aqueous projects in Bashgydromet observation system interfere in real situation revealing on dynamics of ecological conditions change ability in aqueous complexes, the latter integrally reflecting the change ability of environmental condition in their basins on the whole.

Taking into account the above said we consider it expedient to take the following measures in the nearest future:

- correction and unification of observation network entering the ecological monitoring of the Republic using the experience world over;
- widening of observation network within the republic, aqueous projects included using the principles of geosystematic approach and rational usage of federal and republican financing;
- increase of observation points on aqueous projects taking into consideration the importance of transborder moving of polluting (radioactive as well) substances.

EXPERIENCE OF CREATION AND OPERATION OF CENTRALIZED SYSTEM OF OPERATIVE FORECASTING AND NORMALIZING OF TECHNOGENIC EFFECTS IN SCALES OF THE PERM REGION

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The conventional approach to normalizing of anthropogenic effects within the framework of a system "separate water inlet" - "river - receiver" in zones of high density of technogenic loads can not be considered acceptable at present. Introduction of a river basin principle, the complete account of pollution sources in scales of river basin observes, analysis and coordination of interests of all waters users are necessary.

In conditions of economic instability, decrease of industrial technological discipline, significant growth of number of technogenic failures, connected with pollution of surface water objects, the development of centralized systems for not only normalizing, but also for operative forecasting of consequences of failures becomes rather urgent.

Given systems of forecasting permits to choose optimum tactics of liquidation of consequences of failures, to learn it beforehand on the basis of the model of the problem situations.

Under the task and at direct participation of Perm Region Committee of Environmental Protection the system of operative centralized forecasting and normalizing of technogenic effects on water objects, received name "KAMA" is developed in the last years and at present introduced in industrial operation at present.

It includes:

- Information database on:
- hydrological and hydrochemical mode and morphometric characteristics of water objects - receivers of sewage,
- technical characteristics of reglament water systems,
- characteristics of potential danger of technological objects,
- toxicological properties of pollutions;
- Package of models for accounting of processes of dilution, transformation, migration of pollutions in water objects.

Thus the choice of optimum model for particular conditions is made automatically depending on:

- Completeness and accuracy of the initial information of the hydrological, hydrochemical and morphometric characteristics of water object - receiver sewage;
- Water system mode and characteristics of considered pollutions;
- Duration of a period for forecasting.

The complex of models, included in the program, together with the information of databases permits to decide following problems:

- To conduct dynamic normalizing and establishment of the specifications of Maximum Permitable Pollution Outplay on a principle of river basin for a declared water system;
- To execute the analysis hydrological and hydrochemical mode of water object - receivers;
- Forecasting of possible zones of pollution of surface water objects in view of possible migration and accumulation of heterophase inconservative pollutions in separate parts of a system "water" - "weighted pollution" - "bottom adjournment";
- To evaluate parameters emergency outlay on the basis of measuring of pollution distribution in water objects.

The given complex is developed for the operating system MS DOS and Windows, oriented on personal computers of a type 486 DX4-100, Pentium 90.

THE INFORMATION COMPUTER SYSTEM FOR THE STATE MONITORING OF THE GEOLOGICAL ENVIRONMENT IN APPLICATION TO THE CENTRAL AREA OF THE RUSSIAN FEDERATION'S EUROPEAN PART

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The information computer system for the State Monitoring of the Geological Environment (ICS SMGE) is under development on order of the State Geological Committee and makes a part of the State Digital Information Bank on Geology, providing the relevant sections of the bank with information. The software for the system is being worked out by Geosoft-Eastlink Joint Venture. The ICS comprises five subsystems, these are:

– REGION subsystem is dedicated to solving problems of the federal and also regional range as part of the federal one. The subsystem is based on GeoLink, a specialized geographic information system. The system is put into pilot operation by the SMGE Regional Division of the Central Region Geological Centre (CRGC).

– TERRITORY subsystem is oriented on tasks of the territorial level (territory of a subject of the Federation) and based on GWM, a processing computer system. It can be supplied with specialized software for simulation, including permanent models. The subsystem works in more than 40 SMGE Territorial Divisions, almost all Territorial Divisions of the Central Region Geological Centre run it.

– LICENCE subsystem was built for information support of mining activity licensing and it is linked to REGION and TERRITORY subsystems. Now it is tested on geological objects of the Central Region Geological Center.

– POLYGON subsystem is devoted for automatic data readout from sensors and remote devices, data transmission, processing and analysis of long observational series, and forecasting. The subsystem is developed for usage at the testing fields of the State Geological Committee and it enables automatic information readout from the devices of OTT MESSTECHNIK, the world leading manufacturer of the hydrometric measuring equipment.

– OBJECT subsystem is supposed to deal with geological monitoring of exploited mining objects, it is under development now.

The SMGE data bank is two-levelled. Territorial level data bases contain basic (primary) information, also here comes all representative information from OBJECT and POLYGON subsystems. Federal and regional level data bases contain generalized and folded information on corresponding territories.

Nowadays the Central Region Geological Centre and Geosoft-Eastlink started testing of combined operating of all ICS SMGE subsystems, including subsystem interconnection, data transmission from territorial divisions to the regional division and connection with the State Digital Information Bank on Geology.

MONITORING OF WATER OBJECTS POLLUTION BY A SET OF INDICATORS AS AN ELEMENT OF THE UNIFIED STATE SYSTEM OF ENVIRONMENTAL MONITORING OF THE REPUBLIC OF BASHKORTOSTAN

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Since 1993 works on creation of the Unified State System of Environmental Monitoring of the Republic of Bashkortostan (USSEM RB) have been carried on. The USSEM RB is an automated information system intended for providing government organization engaged in environment protection activities with comprehensive, objective and effective information for environmental management in the Republic of Bashkortostan.

Subsystem of water objects monitorings is one of the USSEM subsystems. Data of state inspection organization, as well as data obtained by automatic monitoring stations (for solving the problems of water objects state monitoring) are used as information sources of water objects pollution level. The paper represents the results of data processing related to the Belaya River.

The Belaya River is one of the largest water objects in the Republic of Bashkortostan territory. For obtaining comparable information on the Belaya River sections pollution by a set of measurable parameters we process monitoring results per separate quality indicators applying the method of a generalized parameter (MGP) as an element of the water objects monitoring subsystem (1).

Average concentration values of water quality indicators represented in the year -book of Hydrometeorological Service are being used as initial data for calculations.

Using the method of a generalized parameter (MGP) implies reduction of initial data to dimensionless values. Two ways of norm-fixing were considered: the first way is based on maximal tolerant value (MTV) for the s-th contaminant and the second one is based on exceeding concentration values over the background concentration at a fixed location. The background concentration is an average concentration corresponding to the s-th contaminant at the fixed location of the test point.

Using MGP with the above ways of norm-fixing allowed the following :

1. to evaluate the distribution of the complex indicator characterizing the water objects pollution level by locations of test points;
2. to reveal the river sections for which the increase of the complex indicator characterizing the pollution is the largest
3. to evaluate quantitatively the share of large industrial centers in water objects pollution.

Comparison of the result obtained by using MGP with the landscape map of the RB obtained as a result of aerospace photographs processing allowed to assess the degree of the Belaya River pollution by the diffusion sources. Operations with spatially distributed data were carried out with the help of GIS ARC/INFO.

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SPECIALIZED FACILITIES FOR VOLTAMMETRIC WATER OBJECTS MONITORING

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The problem of rapid operative waters quality check has large-scale character.

Efficiency of such check can be reached only being carried out on the stationary grounds without lengthy transportations of the samples.

High cost of the traditional equipment used for ET AAS and MS-ISP automated analysis, high requirements to its maintaining practically exclude possibility of their usage in small laboratories which carry out routine analysis on the stationary grounds.

In connection with this fact there is a need in sample and not expensive analyzers, which are secure and portable and don't need scarce expendable material, high-skilled maintenance, able to operate in the mobile laboratories.

Stripping voltammetry corresponds these requirements more completely. Advantages of voltammetry (VA) as electroanalytical method are well-known [1,2]: high sensitivity combined with sufficient accuracy and correctness, selectivity, possibility to specify inorganic and organic impurities, compact equipment. Practically all the exotoxical significance metals (Cd, Pb, Hg, Cu, Zn, Ni) can be specified by VA method. Besides, voltammeric analysis of waters doesn't need burning operation stage and in this case VA has advantage over all the other methods.

To realize VA potentials it's necessary to use specialized equipment, electrodes and methods for automated analysis.

In all the above-mentioned aspects there is certain progress [3,4] thanks to which the method is being wider introduced into environmental monitoring and gets juridical status. Thus, VA is an official method for specifying toxical elements in water and foodstuff in a number of countries (Germany, USA, etc.).

During 30 years the TPU VA-analysis laboratories recognized as A.G.Stromberg scientific school

have accumulated enormous material dealing with all the aspects of electroanalytical chemistry and confirming high potentials of the method.

In 1990 "Technoanalyt" enterprise was created to realize this method on the basis of these laboratories. These works, some results of which have been reported at the Congress "Water Ecology and Technology 1994" are being intensively developed at the laboratories of TPU and SPE "Technoanalyt".

The works have complex character and are aimed to provide VA-analysis in the analytical laboratories with methodics, equipment, their certification, automation, hardware and software.

On the basis of long standing experience on elaboration and introduction of the equipment, software and analytical procedures activity, a certain scheme of interaction with users has been created. The key moment in this scheme is mastering of VA-method fundamentals and analytical procedures in the SPE "Technoanalyt" as a result, time of mastering is getting shorter and false interpretation of results got by unskilled use is can be minimized. The reverse contact with the user being realized and this allows to carry out elaborations in the course of his interests.

The TA-1 type analyzer has been elaborated and is produced since 1995, it's characterized by the fact that a 3-channel VA-stand, UV-irradiator and interface are combined into one monoblock. The TA-1 analyzer is supplied with electrodes vibration system which allows to increase sensitivity and reliability thanks to more effective concentration and regeneration of the electrode working surface.

All the operational and control modes are provided by IBM-compatible personal computer. The software is convenient, flexible and easily mastered. Automarking - out and identification of peaks mode, blank substraction decreases the time of analysis and increases automation level.

The TA-1 analyzer is included into the State Register of Russia under the number 15279-96.

The TA-1 maintenance practice (introduced more than 150 devices) shows that in many cases it is more preferable than AAS and other devices.

SPE "Technoanalyt" produces also equipment for photochemical pretreatment of samples (UVI-20), which allows to irradiate from 3 to 9 samples simultaneously.

It's planned to produce programmable fast-acting furnace of PB P-2 type for evaporation and ashing of different samples. Time of heating up to 650°C and time of cooling is about 3-5 minutes.

Production of analyzers, optional equipment, accessories, their introduction and maintenance is carried out by SPE "Technoanalyt".

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SOME ASPECTS OF GROUNDWATER MONITORING IN THE RESEARCHES OF GEOSYSTEMS TOLERANCE FOR THE HUMAN ACTIVITIES

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Environmental health is one of the most important problems today. The human activity becames a significant geological factor. The necessity arose for the research on the admissible limits to human activities effect on the environment. It becames possible to estimate the environment's response to the human activities by geological, hydrogeological, geomorphological and other approaches. The possibility of analyzing the mechanism of the environmental tolerance for different kinds of damages associated with human activities and to determine the admissible limits to human break into nature is also taking place.

The underground water is the most dymanical and impartial evidence of the environmental health. That is why the geological monitoring is a significant point to the studies on the geosystems tolerance for human activities.We must be sure in the data obtained reliability and the observation network truthworthy.

The technique and the technology applicable to the formation of the regime area network for hydrogeological monitoring have been developed due to the prolonged studies on the system of the groundwater regime survey. The approach is based on studies and evaluation of the spatial changeability in the groundwater regime within the geosystem observed. The main point of the technique is the natural and genetic approach which relying on the setting off the local geosystem as the elementary subject of the monitoring. The geosystems' setting off is grounded on the unity of the geostructural,

geomorphological, climatic and other factors which determine the commonness of the geosystems' balance in matter and energy. Under such an approach the developed technology of the network formation must enable the uniform within the area density of data on the underground water regime as well as the accuracy and efficiency of the observations.

The special model is developed in order to give an idea of the surface and the ground water mineralization within the geosystem. The distinctive characteristics of the regime are given in the context of the model in sum of the definite and incidental components including the estimation error. The mathematical methods for the evaluation of the spatial changeability in the groundwater regime allows us to estimate the degree of measurements' dependence on the distance between the wells and their mutual arrangement. As a result we can define the points of wells location in concrete natural conditions. The calculations follow the data on data have been obtained from the representative parts of geosystems which have the surplus observation network. The observation data obtained are used during the period of highest regime changeability.

The proposed technology in addition to the initial hydrogeological analysis includes the maps' automated drawing and comparison as well as the definition of the absolute and area error in the evaluation of the groundwater regime index using the preliminary defined gradations of its changeability, and the additional number of wells accommodation in any place of interest for the researcher with the evaluation of the new survey point significance.

The proposed technology permits us to optimize the observation network in order to carry out the hydrogeological monitoring, with its most effective use in the regions of hydrotechnical construction and in the irrigated lands. The interpretation of the data gained allows us to answer a number of questions arising from the research on the geosystems and the whole biosphere tolerance. The data obtained will be of great importance in the environment tolerance for the human activities research; they will find application in the environmental health evaluation and in the development of actions on nature preservation.

ELECTROCHEMICAL METHOD OF CARBON DIOXIDE CONTROL IN WATER

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An electrochemical method of dissolved carbon dioxide determination in water has been worked out based on adsorption and catalytic characteristics of the platinum metals.

The method represents the development of the investigations that have been carried out for years in A.N.Frumkin Institute of Electrochemistry on electrochemical methods for organic and heavy metals impurity control in different types of water [1-2].

The most widely used electrochemical methods of carbon dioxide control are based on the determination of the conductivity and pH changes due to carbon acid formation [3].

The proposed method can be used in the solutions with a high and variable content of inorganic substances (which can affect the conductivity and pH value) where the above mentioned methods do not work.

The electrochemical sensor consisting of solid electrolyte in the form of Nafion-type membrane and platinum electrode can be inserted into flow of water for continuous monitoring.

A electyronic device has been designed, which can operate as an automatic analyzer or as a signal device producing an alarm signal at exceeding of the permissible level of carbon dioxide content in water.

The sensituvity of the method amounts to 1% of the concentration of the saturated CO_2 solution in water at given temperature. The time of an analysis is 15 min.

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HE POSSIBILITIES OF SELECTIVE DETERMINATION OF POLYCHLORINATED DIBENZO-P-DIOXINS BY FINE-STRUCTURE PHOSPHORESCENCE SPECTRA

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The trace concentrations of dioxin xenobiotics are presently determined by chromato-mass-spectrometry method. Inadequate selectivity when detecting isomers is one of the drawbacks of this method. This fact outlines the search of new analytical methods as a topical problem. The discovery of the Shpolskii effect offered possibilities to develop high-sensitive, rapid and selective methods of spectral analysis. Molecular analysis, based on fine-structure luminescence spectra registration is well-developed for analysis of polycyclic aromatic hydrocarbons (PAH). The traces of PAH in air, food and other objects are determined with the help of this method. The fine-structure luminescence spectra of that class of compounds were thoroughly studied and described in scientific literature, the atlases of fine-structure luminescence spectra of this compounds were compiled. At the same time the data on fine-structure spectra of dioxins are almost unavailable.

In our paper we report the results of investigation of phosphorescence spectra of polychlorinated dibenzo-p-dioxin isomers at the Shpolskii effect conditions (in hydrocarbon matrixes at 77 and 4.2K). It is established that in some n-hydrocarbons dioxins phosphorescence spectra have a quasi line character and a clearly defined vibronic structure. The properties of fine-structure phosphorescence spectra of polychlorinated dioxin are revealed. Inferences about the possibility of creation of reliable method of these isomers identification in complex mixtures were made. The sensitivity of this method is about 10^{-11}G.

THE AUTOMATION INFORMATIONAL SYSTEM OF TREATMENT AND OUTPUT OF HYDROCHEMICAL ANALYSES OF THE QUALITY OF WASTE AND SURFACE WATER DATA (AIS "HYDROCHEMISTRY")

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The automation information system of treatment and output of hydrochemical analyses of the quality of waste and surface water (AIS "Hydrochemistry") is developed by the Institute for water Resources Management according to the structure of data, determined by "The Instructions on selection of tests for analyses of waste and surface water " and by the model of the characteristics register which is directed by ecology committees.

The AIS "Hydrochemistry" is intended for information provision of republic, regional and district executive and representative organs, ecology committees, ministries, departments, designing, scientific-research and other organisations by laboratory analyses of the waste and surface water data and also by the state statistical account of water users data on the sizes of discharged waste water, which contains pollutants.

The information base of the system includes initial data of reports on selection tests, registers on quality characteristics of waste and natural water , and also data of statistical records of water users on the sizes of waste water and amount of pollutants, which it contains, reference books and classifiers of the object of administrative and territory division, enterprises and organisations, fields of economy, ministries and departments, water systems, maximum concentrations of pollutants which are a part of waste water, rates of ecological tax on waste disposal.

The system provides the output in the dialogue mode of both the basic and the generalised data in basin, territory, industrial and department contexts, and also according to the diapason the output of quantitative indices of concentrations of pollutants in waste and surface water, according to the dates and places of selection of tests, to categories of discharges, etc. Besides, it's possible to choose enterprises and organisations, admitted water disposal with exceeding maximum concentration of the given water disposal with exceeding maximum concentration of the given multiplicity (according to the correlation of actual concentrations with maximum concentrations) within a river basin or its part, within a territory, industry, ministry, department or a separate enterprise. Besides, the output of correlated indices the entry and outlet of purifiers, upstream and downstream wastewater sewers, in the previous and account year or many years is provided. The output of data is executed both in the form of initial documents (a report on selection of tests, registers on quality characteristics) and in the form of tables, which contain mean and extreme data of quality characteristics and ecological tax on

waste disposal. There is also provision for the output of separate indices in the form of tables, formed by the system user.

The programmed provision of the AIS "Hydrochemistry" contains five interdependent subsystems:

1) putting into operation and control of data of hydrochemical analyses of waste and natural water;

2) control of state statistical account data on the amount pollutions is discharged waste water ;

3) service initial data provision;

4) generalisation and output of concluding data on unregulated inquiries;

5) control of the ecological tax on waste disposal.

AIS "Hydrochemistry" is being planned to develop in the following directions;

1) forming water quality balances in river locations;

2) joint generalisation, analysis and output of data on water quality in river locations ranges, recorded by the hydrometeorological service, and on water quality upstream and downstream waste water sewers, and also discharged waste water quality, recorded by ecology committees and separate enterprises.

3) graphic interpretation of the outputted indices.

UNIVERSAL PORTABLE SPECTROMETRIC ANALYZER OF RADIONUCLIDES

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The perspectivity of active method of gamma-background suppression for radionuclide analysis of aqueous samples using non-shielded scintillation gamma-spectrometer is discussed.

Gamma emission of almost all radionuclides of practical interest is accompanied by simultaneous (up to several nanoseconds) emission of alpha- or beta-particles. In the case of thin layer sample the detection of gamma-quanta in coincidence with charged particles suppresses the influence of background. That increases the device sensitivity up to the level of the spectrometer based on a cooled Ge-crystal of large volume in lead shielding. The gamma-emission is not accompanied by simultaneous emission of charged particles only for K-10 and Cs-137 isotopes, which usually provide the main part of gamma-quanta emitted by the sample. That leads to increasing of the device sensitivity for other isotopes

Moreover, the detection of gamma-quanta and charged particles in coincidence makes it possible:

- to determine gamma and particle registration efficiencies without reference standard samples;
- to fix surface geometry of the measurement;
- to compare two gamma-spectra measured with and without coincidence for facilitating the radionuclide identification.

The simultaneous registration of gamma-quanta and charged particles makes it possible to detect pure alpha- and beta- emitting nuclides on the background of alpha-or beta-particles of gamma-emitting nuclides using comparison of particle and quanta intensities. For example, Sr-90 beta activity on Cs-137 background, or total alpha activity of U-238 and Pu-isotopes at the presence of U-235 or Am-241 can be measured without radiochemical separation and particle energy spectrum measurements.

Coincidence method for radiation monitoring has been studied at Radium Institute [1]. A portable 1024-channel spectrometer was designed by "Producer's and developer's monitoring system association ASM" company on the base of NaI (Tl) gamma-detector and surface-barrier silicon detector. The device provides the simultaneous measurement of three gamma-spectra (in coincidences with alpha-particles, beta- particles and without coincidences) and separate counting of alpha and beta particles from the sample. Automatical emerge calibration and stabilization of gamma-spectrum measurement are carried out using reference Eu-154 source with activity of about 10 Bq. The reference gamma-spectrum is separated from the total one by the coincidence method. The device is controlled by internal computer with graphical display, powered by external dc source (10-14 V) or by built in battery which provides 8-hour capacity for the device work. The weight of the device is 8 Kg, the overall dimensions are 350x230x120 mm, The device design permits to connect an additional semiconductor detector for alpha-spectrometry, standard gas-discharge detector and external IBM PC using a serial port. It makes the device an appropriate universal tool for radiation monitoring at the laboratory and in the fields.

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THE EXTRACTION CONCENTRATION AND SEPARATE DETERMINATION OF CARCIOGENIC NAPHTOLS IN THE WATER MEDIA

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Poly-substituted derivatives of naphthaline containing hydroxy-, sulfo- and nitroso-groups are very important semi-products in producing of synthetic dyes, in that number for cellulose and protein. They can occur in sewages of perfume and pharmaceutical plants, nature waters, agricultural sewages. Introducing in molecule additive substituents decrease toxicity of the compound in comparison with the initial compound (naphtaline), but products of metabolism of the substituted compounds are not less harmful for man and environment. Besides it, presence in water reservoirs easily oxidized poly-substituted derivatives changes oxiganbalance of reservoirs. Control of naphthols amount in water media can serve for estimation of plant pollution by carbamate pesticides (for example, carbaryl).

The methods of influence on the water sample, allowing to extract almost completely the carcinogenic naphthols by the one-fold extraction process has been worked out. These method are based on the solvotropic, synergetic and salting-out effects and the use of hydrophilic solvents and their mixtures with hydrophobic extragents. The selectivity of determination has been reached at the stage of photometric determination or the use of successive elution by the extraction-sorption separation.

The methods of separate determination of naphthols microquantities in water solutions include:

- selective determination of naphthols in the presence of volatile phenols;
- separate determination of 1- and 2-naphthols (1-naphthol concentrating from water-salt solution by propionic acid, extract photometry);
- selective determination of naphthols and naphtholsulfoacids (extraction of naphthols and the determination in the reextract, the following extraction of naphtholsulfoacids from water-salt solution by the hydrophilic solvent);
- separate determination of naphthols and diphenylamine (the pH variations, the use of specific photometric reagents);
- selective determination of 1-naphthol and 2-nitrozo-1-naphthol (the use of extragent placed on the polymer sorbent and the use of selective eluents).

Innovation of proposed methods is confirmed with authors certificates. Methods are expressive, give reliable determination of carcinogens on the level of 0,05-0,1 mg/l and low, were probed in plant conditions. For analysis performance expensive and/or stationary equipment, rare reactants are not required.

THE EXTRACTION-CHROMATO-LUMINESCENCE TEST-METHOD OF THE DETERMINATION OF METHYLSALICRYLATE LETHAL DOSES IN WATER IN THE PRESENCE OF SALICYLIC ACID

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Methylsalicylate is a toxic compound with allergetic action. Lethal dose for man is 30 mg.

Methylsalicylate is synthesizes from salicylic acid therefore in sewages of the appropriate chemical industry both of these compounds are occurred together, more over, methylsalicylate can occur in local sewages of pharmaceutical plants.

Determination of methylsalicilate in the presence of salicylic acid requires preliminary separation.

Mass-spectral method of determination based on separation of compounds in gaseous states is proposed. The method is characterized with low levels of determination, high selectivity, requires complex equipment and managered staff.

Separation by the method of chromatography in thin leper on polyamides is possible. The of the method is duration of the process of plates preparation covered by polyamide. Time or preparation is 12 hours.

Decision of ecological problems requires introduction of expressive and relatively simple methods of toxicants determination.

Test-method of lethal doses determination of methylsalicylate in water is developed. The method includes extraction, separation by chromatographic method on paper in eluate flow (ammonium buffer solution) and testing of component zones at ultraviolet lighting of chromatogram.

Analyzed water probe acidified hydrochloric acid up to pH=1-2 and extracted with chlorophorm. Drop of the extract placed in the center of chromatographic paper (round chromatography) and eluted by ammonium buffer solution, than chromatogram placed under ultra-violet lighter. On chromatogram zones of methylsalicylate (blue) and salicylic acid (violet) are appeared. Limit of determination of methylsalicylate is 30 mg/dm^3 in the presence of 40-fold exceis of salicylic acid.

Proposed method allows during 10 min. to estimate presence in water harmful dose of methylsalicylate and expressively decide a question about necessity of water purification from allergen.

Extraction - chromato -luminescence method or methylsalicylate determination is sufficiently selective.

Coefficients of methylsalicylate and salicylic acid mobility in recommend conditions of separation are 0,88 and 0,14 respectively, that allows to determine methylsalicylate relatively selectively at high concentrations of admixtures of salicylic acid.

Equipment and reactants uses for analysis performance (ultra-violet lighter, chromatographic paper) are accessible for any laboratories.

ORGANIZATION OF THE MONITORING AND QUALITY CONTROL SYSTEM OF THE SURFACE WATER FOR THE RIVERS OF THE NIZHNY NOVGOROD REGION

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On the basis of the analysis of the antropogenic load on the major water objects of the N. Novgorod Region, formed by the technogenic activity of industrial agglomerations the strategy of achievement the main purpose - to maintain stability of the ecological system of the industrial system of the Region and to create conditions to enter a regime of stable development - is outlined. Geographical situation of the N. Novgorod on the two main rivers of the central Russia links naturally problems of stability with the a condition of the Oka and Volga of all. These problems appear in two interrelated aspects:

- maintenance of a normative structure of the water, coming to the consumers in a Regional Center;
- preservation of the Volga ecological system situated below 1,5 million industrial Center.

Strategy of fulfillment of these aims at the present circumstances is connected, first of all, with creation of a band of ecological safety of the N. Novgorod. Within the framework of this task, creation of the automated system for river monitoring in the N. Novgorod Region, becomes of a priority significance, as a cheapest and the most effective mean of establishing on optimum relation between the Regional industrial complex and ecological safety of the population.

The following issues are considered in a number of the main aims of the Monitoring system:

- systematic appraisal of the state of the water objects on the bound of the Region as well as in the area of the sources of industrial pollution and water supply;
- duly recognition of the beginning of development of the situation of emergency and modeling of the spreading of the area of the water flow, dangerously polluted;
- development of the system for notification of the water - supply enterprises, Regional Administration and nature protecting organizations.

Principles of the supervision network construction:

- developing the territory zones of the water objects;
- establishing of automatic posts of continuos supervision within defined zones; automated stations of the operative control and maintaining data output on a real time; stationary laboratories of physical-chemical analysis, insuring processing of probes during 2-3 hours from the moment of selection.

The Automated system of Monitoring of the rivers of the N. Novgorod Region includes complexes of collection on processing of the information from posts and stations of control, supplying measurement data and adding their bits of information for the use of regional level of administrative and nature protective management. Analytical, expert activities as well as maintenance of interaction of specially authorized bodies ace coordinated by the Center of Ecological Safety working under authority of the Regional Administration, basing on the operative and simulated solutions.

Experience of establishing of the first five stations of early prevention of the ecological emergencies and economical effectiveness of the Monitoring System are analyzed. Base parameters of informative - communicating networks, specifications chosen and proposed for inclusion to the system of the means of evaluating are indicated.

NEW POSSIBILITIES OF FLUORESCENT ANALYSIS OF WATER POLLUTION

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The theoretical concepts, makeup, properties and service history are discussed.

1. The complex of automatic control of aluminium, active chlorine and ozone in water. Certified method of analysis are realized. Automatic flow-injection sampler, fluorescent-chemiluminescent detector are part of the complex. The sensitivity is: Al - 0.01 mg/l, active chlorine - 0.001 mg/l, ozone - 0.0001 mg/l. The sampling frequency - 1- 10 per hour, sampling period - 15 minutes.

2. Automatic analyzer of organic pollution in water. Detecting component are oil products, water pyrogenity. The sensitivity is - 0.05 mg/l. The sampling frequency - 1- 60 per hour, sampling period - 1 minute. Optical sound, optic fibre chemilumines cent detector are part of the complex.

3. Laboratory analyzer of water pollution "Fluorant-02". Detecting components/sensitivity (mg/l):

oil products/ 0.005, **phenols**/0.0005, **nitrites**/0.005, **sulphides**/0/005, **nitrates**/0.1, **cyanides**/0.02, **atrozine**/0.001, **simazine**/0.001, **benzo(a)pyrene**/0.0001, **chlorine**/0.001, **AL**/0.01, **Cu**/0.005, **Zn**/0.005, **Mn**/0.005, **Fe**/0.05, **B**/0.05, **Co**/0.0002, **Cd**/0.0005, **Cr**/0.002, **Sn**/0.01, **Pb**/0.001, **Ti**/0.1, **V**/0.025, **Be**/0.0005, **Se**/0.0001, **U**/0.0002, **Ni**/0.01, **water pyrogenity**/ 0.1 min. doze.

SPECIFIC CHARACTER OF HYDROCHEMICAL MONITORING FOR RESERVOIRS

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The single state of ecological monitoring is being created now in Russian Federation and the Russian Committee of Water Resources must carry on the supervision the water - resources subsystem.

As it is marked in the new Water Code the Object of monitoring is the opportune revelation of negative processes and prevention of injurious consequences. For the first time it must deal with those water objects which are created and operated by the people themselves. A regional reservoirs experience the influence of much more Factors than the natural ones.

They are more perceptible for any influence, in the result of which the balance in ecosystem can be broken, the intensification of the process inside reservoirs takes place and their natural stability decreases. By the way observation and control posts don't take into account the specific character of reservoirs when investigating. Two consequential documents "The leading principles of ecological approach to water supply activities" and "The estimation criteria of ecological situation for territories to reveal zones of extraordinary ecological situations and zones of ecological calamity", which were issued not long ago, don't take into account the concrete type of the water objects in the process of its studying.

When studying reservoirs it is necessary to come to understand the transformations in water environment, processes inside reservoirs which form character of the chemical composition of water. Hydrochemical monitoring is informative because the studying ingredients have the connection with the whole system of limnological processes, they have the possibility of exact expression and it is possible to determine the connection waterability with the help of them.

The South Urals department of Russian Research Institute of Water Management uses the method which principle position is complex examination of water and chemical outflow in the frames "river - reservoir" when dealing with reservoir monitoring.

Direct proportionality between the changes of this parameters is received as natural level. The deviation from it testifies the direction of the processes: to the removal of ingredients from water environment (accumulative stage) or to the enrichment of it (a regional stage).

Numerical quantity shows the degree of deviation from the natural level: weak (poor), standard, considerable, great and enormous. When contamination of reservoir is considered according to its ecological stress degree. For the basis of this degree gradation (for critical and crises situations) the deviation from natural level more than 50% is accepted. Just the same for catastrophic situation (zone of ecological calamity) - more than 90 % is accepted.

For the treatment of the received results we use the programme of connection between changes of chemical and water outflow in the system "river - reservoir".

It is necessary to make out that representativity of this results is in great dependence on studying period; the observation of the year cycle including all the phases of water regime is the most informative.

The analysis of ingredients conduct in the reservoir demonstrates that some of them have the same tendency to changes.

The first of them are disposed to accumulation (silicon), the second - to carrying out to tail water (organic forms of nitrogen and phosphorus), the third - to conservation of natural level (hydrocar-

bonates). That's why the selection of ingredients is being choosing in accordance with the character of basin assimilation.

In the case of allocation in waterside zone of industrial objects these ingredients are sulphates in agricultural and built up areas- mineral forms of nitrogen and phosphorus.

Suggested method allows to mark not only the ecological situation but also the direction and "power" of the necessary water protection measures.

CYBERNETIC BASIS OF MONITORING

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In order to implement the principles of protecting of nature there is necessity to construct a management system.

Implementation of measures in monitoring of water resources either in a certain region or city or water basin may be achieved by means of creation of Cybernetic System. Juristical aspects of management was defined by decisions of the Russian State at the different times.

Basis of management of water resources was laid out by the report being based on the cybernetic scheme (Look at Picture 1) and economic laws.

It serves to solve the certain task-analysis and synthesis of ecological System which may be considered as an industrial-economical process of monitoring.

On the whole there are distinguished six blocks in the management System (Picture 1). Elaborating of the system demands taking into consideration of external environment (B1, B2, B3, B4) which directly influence to function of system.

That is why, great attention must be paid to such fields of management knowledge as engineer ecology and biology, accidental change of environment, influence of resources (personnel, material-technical, financial, time etc.). The reasonable division of the system into functional blocks makes it possible to analysis and to define management tasks clearly. Let us make out distinguished blocks of management in the picture.

Block 1. Direction (D) or Management body. Functions of this block consist of making and transmission of commands, orders, instructions, etc. and also rendering assistance in achieving high economic and ecological results. This block may be influenced accidental factors by B1 and B2.

Block 2. Management mechanism (M). This is a set of normative acts giving management parameters to the management process. The function is to build the matrix of {P(i, j)} of the calculated parameters for the period of management (month, quarter, year, five years etc.). Realization of managing information shall be achieved by means of management matrix {P(i, j)}

$$P_{ij}^{m} = \begin{matrix} P_{11}^{m}, P_{12}^{m}, P_{13}^{m}, \ldots P_{1n}^{m} \\ P_{21}^{m}, P_{22}^{m}, P_{23}^{m}, \ldots P_{2n}^{m} \\ \ldots\ldots\ldots\ldots\ldots\ldots \\ P_{n1}^{m}, P_{n2}^{m}, P_{n3}^{m}, \ldots P_{nn}^{m} \end{matrix} \quad \{1\}$$

Block 3. Resources (R). The function is to obtain the system by Resources in order the mentioned task might be solved. Resources may be finances, labour power, time, etc. Analysis of authors show that, nearly 3-5% of national incomes are to be put in ecology.

This block is the foundation of system functioning. Shortage of financed resources is the "bottleneck" of the cybernetic scheme.

By analogy with formula {1} enumerated price formulae are expressed by the matrix of resources {R(i, j)} and it is moving power of the object of monitoring valuable obstacle in the ways of improving of monitoring is unsatisfied financial maintenance.

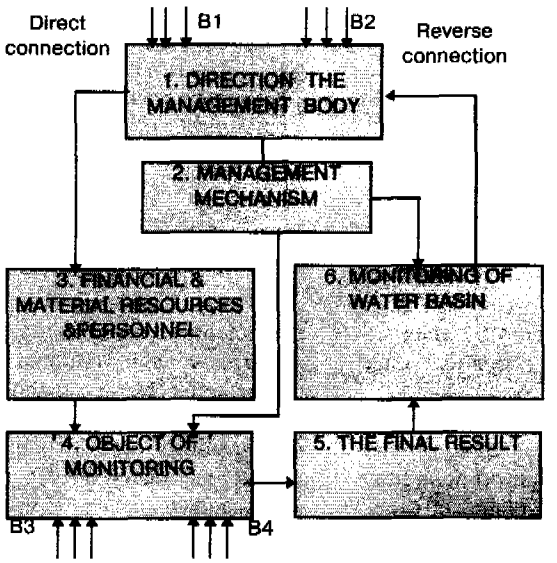
Block 4. Object of management (OM). This may be a region, and district, water basin, etc. over which monitoring must be carry out.

Functions are fulfilling the precised economic-ecological tasks. However, it is very difficult system of "man-machine-environment". The block may be influenced accidental steams by B3 or B4 which may be followed by extraordinary or catastrophic situations. All published works, normative documents meant for normal conditions about extraordinary situations is looking for their theoretical and practical solutions.

Block 5. Final result (F). These are outlet parameters of monitoring which are the final stage cybernetic scheme and are expressed by the numeric matrix of K-{K(i, j)}.

Block 6. Monitoring of water Resources (MO). Function is to compare the parameters of monitoring. To be more correctly monitoring compares two matrix; {P(i, j)} with {M(i, j)}. For this purpose mathematical device for comparing of pair shall be used. The result matrix {D(i, j)} is to be send to Block 1 - Management body. Object of research is also mathematics models of controlling in accordance with the method of A. Volda.

Cycle of management (month, quarter, year, etc.) is finished by sending of matrix {D(i, j)} to Direction.



Pic. 1. Cybernetic scheme of monitoring of water resources.

THE CHARACTERISTICS OF THE CONDITIONS OF APPLICABILITY OF EXPRESS METHODS FOR THE DIAGNOSTICS OF SALT-AFFECTED SOILS AT RECLAMATION RESEARCHES

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At reclamation researches of salt-affected soils the studies of a degree of salinization are of great importance. In Aral-sea region, a classical method of suspension is usually used for these purposes, but that requires a plenty of time and a lot of work. At the same time, for the general characteristic of soil it could be frequently enough rather general conception about ionic- composition soluble salts, that might be easily achieved by methods of express- analysis with the using of the data of the electric conductivity and activity of the basic ions. Our researches have demonstrated that these methods are also applicable in the Aral-sea region, and the scope of the conditions, in which the results are uncorrupted, is limited.

In particular, it is possible to get the most satisfactory results using the express-diagnostics of the soluble salts content, and also activity of Cl^- and Na^+ in soils on parameters of their activity only for sandic and clayic soils.

For sandic soils thus it is possible to use following regressions (where the EC- electric conductivity [mSm]; SC- salt content (concentration of soluble salt (g/l) in suspension soil:water=1:5); $[Na^+]$, $[Cl^-]$ - content of ions in mg.ecv/100g of soil; aNa^+, aCl^- -activity of ions (moll/litre) in paste (soil:water=1:1)).

SC=0,40 EC-2,25 (At the EC> 4 mSm);

$[Na^+]$ = 0,36 aNa + 0,06; $[Cl^-]$=0,43 aCl + 0,03.

For clayic soils regression is:

SC= 0,11EC+ 0,66.

TOWARDS PARASITE MONITORING WATER

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The object of the design is development of equipment-technique complex, useful for routine everyday parasite analysis of water in water systems and sanitary services, and able to become in the Russian standard.

The urgently of the problem becomes more obvious because development of parasite analysis techniques has permitted to attribute series of waterborne intestinal disease outbreaks in USA to Giardia lamblia and Cryptosporidium.

Forecast of the intestinal diseases spread is inauspicious: increasing total environmental contamination and decreasing immunity of man will extend prevalence of decease under consideration.

Removal of cysts by water treatment is not sufficient because of their good permeability through sand filters and resistance to chlorination and ozonization. Therefore, usefulness of technological parasite control of water treatment is obvious too.

Therefore, the monitoring lamblia cysts and cryptosporidium oocysts contamination in water is stipulated by project of new Federal Sanitary Rules. However they introduction is restricted by absence of routine, reliable and cheap assay for monitoring water parasite contamination.

The main methodical problem of parasite cysts determination in water is preparation pure sample for microscope investigation. For what purpose they must be extracted from enormous volume of water and number of other particles. Existent techniques try to achieve the end by concentrating suspension on membrane filters followed by centrifuge flotation - purification.

These technologies are restricted in sample volume and authenticity of determination but have high labor requirements.

The problem becomes worse in case of analysis of native water, one liter of which may content some hundreds of thousands of monocell algae, what are not separated with centrifuge purification, and task of operator becomes practically unsolved - to search among them a few parasite cysts with microscope.

Practical bases for optimism.

Research has been undertook and tentative technique of extraction of parasite objects from large volume of contaminated water has been designed by association "AMES".

Originality and usefulness consists of the suspension of cysts is concentrated and purified from mineral microparticles and algae in processes of "selective filtration", that are able to differ cysts from mineral particles on the basis of their hydrodynamics, and from algae on the basis their physiological and biochemical distinctions.

Table. Abilities of technique.

	Potable	Native
Turbidity, NTU/L	< 1	1-6
Sample volume, L	< 500	500-50
Velocity of filtration, L/h	< 200	< 200
Sampling regime	continuous	continuous
Taking time from start of filtration up to result getting, hour	< 3	< 7

REGIONAL AUTOMATED ECOLOGY MONITORING SYSTEM FOR WATER BASIS (AS SAMPLE SAMARA REGION OF RUSSIAN FEDERATION)

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Creation of an effective Regional Automated Ecology Monitoring System for Water Basis **(RAEMS-WB)** in every region involves a range of complicated and interdependent problems of methodical and technological character.

The most significant problems to be tackled are the following:

1.the assessment of regional water bodies (the peculiarities of hydrological and hydrogeological regimes, the principal water quality standards, the structure of water consumption and water diversion, the main sources of water pollution, ets);

2.The elaboration of the requirements concerning RAEMS-WB. Modern requirements regarding monitoring such as an efficient detection of emergencies, a rapid modeling and prognosticating of their development, an opportunity to workout certain advice for productive management decisions, a fruitful co-operation with other regional, departmental, federal systems, in case of emergency for instance, are to be brought into effect alongside with traditional requirements;

3.The elaboration of the RAEMS-WB structure in complacence with the specificity of the requirements about water bodies, regional infrastructure, ets, which might be composed of several hierarchical levels and might comprise regional and zone information analytical centers **(RIAC and ZIAC)**, a network of stationary automated control systems, including samplers, traveling laboratories attached to vessels and vehicles, stationary analytical laboratories, communication and information systems;

4.The elaboration of the territorial distribution plan for the RAEMS-WB. This task is to be ensured by the distribution of RIAC, by fixing the number of ZIAC, by defining the number and the functions of stationary automated control systems as will as of the centers which provide periodic control by mobile means;

5.The selection of technical means of RAEMS-WB. Basic technicalmeans designed to receive, transmit, store, process and analyze the information are to be singled out. The optimal list of controlled water quality standard is to govern selecting the requirement concerning measurement means;

6.Working out the priorities over the course of brinding into action the RAEMS-WB and the purpose oriented complex program **(POCP)**, its creation and development is of great importance.

In the report all the quide lines and principles mentioned above are considered on the basis of the previously developed scientific research project "The Conception and the POCP of the Samara RAEMS-WB".

THE ECOLOGICAL MONITORING SYSTEM OF UNDERGROUND WATER IN TOMSK REGION

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Solving problems about creating ecological prosperity of some area, in case of increasing of impacts to the underground water, is connected with working out the system of receiving information about spatially-temporal changeableness indices, that determine the condition and quality of natural water. This method can be realized within the limits of ecological monitoring - consist of automatized informational system (AIS), and connected with permanently active hidrogeomigreatory models of the different scales (PAHM). AIS as the regional data base, is using for keeping, primary processing and receiving information about parameters of water-bearing formations, volumes of waterselection, levels and compositions of underground water. Using AIS we also can get information about character of impact to the underground water. The PAHM includes specialized data base (that is connected with AIS), the matenatical simulation system of filtration (exudation) and migration process, the ways of processing and visualization of simulation results. The monitoring let us to learn major processes in action, connected with changing of geological environment, and give cartografical description of ecological situation using geoinformational technologies.

The necessity of creating of ecological monitoring for underground water in Tomsk region stipulated by intensive impact to the underground hydrosphere. This impact has some features, connected with kinds, scales and intensivity of incluense on environment. The most hard ecological situation is in Tomsk agroindustrial agglomeration, that include the land between Ob and Tom rivers, Tomsk city, north industrial zone with large number of industrial enterprises such as Tomsk petrochemical and Siberian chemical plants, agroindustrial complexes, dumps (including dump of liquid radioactive waste products), water extraction stations. There is the special situation connected with the area between Ob and Tom rivers, because underground water of this area is only one capable source of water for region capital. On this territory is situated one of the largest water extraction station in Russia with flow rate about 210000 m^3 (cubic meters) per night, and also there are a lot of individual (single) water ejection wells. There was intensive exploitation of underground water, and it let to lowering of levels. As result there was forming of rather large depression funnel. It was a reasonor draining of upper water-bearing horizons and intensification of pollution of underground water. Using underground water of area between Ob and Tom rivers there is a large problem connected with nearness of dump of liquid radioactive waste products (LRWP*) to the Tomsk water ejection station.

For practical realization of system of ecological monitoring for Tomsk region underground water was created PAHM of OB-Tom rivers area. This PAHM was created to make more optimum observation net, existing and prospecting water ejection station, simulation imagination of maps of pollution and head of underground water, to creation of recommendation about rational using of water resources. Monitoring wall let to continue learning of hydrodynamic and hydrogeochemical conditions of underground water, including estimation of possible influence of LRWR injection into Tomsk water ejection station. Precision estimations are used for managing with rational using of water resources. Besides, methodical ways of using monitoring of underground water, will be widespread to the other objects of Tomsk region. Finally PAHM that was created for individual objects, will turn into the whole geoecological system of Tomsk region underground water monitoring.

SOME PROBLEMS CONNECTED WITH THE ACCREDITATION OF CHEMICAL-ECOLOGICAL LABORATORIES IN THE SYSTEM OF ACCREDITATION OF ANALYTICAL LABORATORIES

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The system of accreditation of analytical laboratories has been worked out to meet the requirements for assurance of accuracy and confidence in the results of the analysis performed by laboratories controlling the environment, sanitary-industrial zones, laboratories of the Ministry of Labour. Health Protection, Agrochemical Complex, etc., i.e. those carrying out the chemical analysis control (CAC) with the purpose of the State control and supervision.

Preparatory steps for accreditation and requirements for laboratories to be accredited:

1.Determination of the fields of accreditation, components and choice of accepted (certified) procedures for their analysis. Filling in the forms the inventory and the certificate of a laboratory.

2.Choice of components for the external samples, usually at least 50% of the whole number of components claimed for every field of accreditation.

2.1.Samples are made on the basis if standard reference materials (certified mixtures) with the addition of impurities.

2.2.Preparation of samples introducing additions into the real objects (waste water, natural water, sea water, and so on). As an addition on uses a standard reference materials.

3.Inspection of the correctness of sample preparation.

4.If the results of external inspection are satisfactory, Form 4 for the CAC is coordinated and the laboratory certificate is issued.

5.Components, which have not passed the external inspection, are excluded from the field of accreditation and can be introduced again only after methodical-metrological examination.

6.Inspection of carrying on the statistical control in a laboratory, keeping records of the works performed, drawing up a manual on quality, laboratory regulations.

Some difficulties arising in the accreditation of laboratories:

1.Providing laboratories with technical documentation, instruction manuals, etc.

2.Lack of the list of accepted procedures for the analysis of a wording zone.

3.Lack some standard reference materials.

4.Need to check the fitness of chemical agents.

5.Limited financial opportunities do not enable laboratories to pass to more modern methods of analysis.

INVERSION VOLTAMPEROMETRY METHOD IN THE ANALYSIS OF WASTE WATER

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For express-control of the heavy metals ions (Cu, Cd, Zn, Pb, Ni, Mn, Hg, Co) contents in waste water the voltamperometric method variant with the inversion of determinating component phase state is used. The application as an indicator electrode the glass-carbon electrode permits to determine the metal-ions in various mediums with minimal concentration 1*10 -7 - 1*10 -8 mole/l, at this the analysis time does not exceed 20 - 30 minutes. The utilisation of mercury-film electrodes (variant "in situ") makes it possible to conduct the analysis og the 2-3 component systems.

The application of this voltamperometry variant for mercury definition in sulution and in air medium makes it possible to execute the express-control of this environmentally dangerous matal. This technique of mercury micro-amounts definition is characterized by high metrological parameters: relative standart deviation - 0.2-0.3, relative definition error <0.15. As a background solution is offered the 4-component composition based on solutions containing I-ions. The kinetic regularities of electrochemical processes are considered. It is shown that the dissilving of a solid phase proceeds by stages including I-ions, thus the one-electronic stage is being control-stage. The influence of extraneous ions on the analytical signal of mercury is revealed, in particular it is shown that the introduction of copper ions with concentration 1*10 -5 mole/l increases the analytical signal and the reproduction of the analysis results.

ECOLOGICAL AND RECLAMATIVE MONITORING AT IRRIGATION SYSTEMS

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As a rule, irrigation systems are located within the boundaries of open or semiopen geosystems, the surface and groundwater flow of which is directed to the base level of erosion - corresponding receiving water body (watercourse or water body).

The disturbances of ecological balance of reclaimed agricultural landscapes and ecosystems of watercourses (water bodies) to a considerable extent can be stipulated by the changes of the regime and balance of soil and groundwaters, increase of intensity of convective and diffusion transfer of water-soluble ingredients, increase of surface and groundwater flow under the impact of water management activity.

Timely revealing of negative processes, forecast of their development, implementation of measures on elimination and prevention of such processes in future can be ensured based on the data of ecological and reclamative monitoring, representing a system of discrete and continious observations of quantitative and qualitative characteristics of soils, irrigation, groundwater, irrigation and drainage and waste waters within the boundaries of a corresponding geosystem.

Landscape-basin approach, allowing to correlate the results of observations of the formation of surface and groundwater which regard for their interaction and interrelation is a systems basis of the organisation and implementation of this applied monitoring, aimed at solving assessment resource, reclamative and ecological problems. In this definition the characteristics of hydrological (water) systems of various order - the volumes and quality of channel flow in the dynamics, modules and quality of overland flow and its spatial variability, are presented as priority indices of the monitoring. The indices of infiltration feed of groundwater, regime and budget groundwater and the volumes of groundwater flow respectively, are the leading indices of the monitoring within the boundaries of the object of lower hierarchic level, corresponding to hydrological structure, - from local to regional level.

The ecological trend of this monitoring at reclaimed areas is related with observations of water quality of surface and groundwater flow both at regional and local levels, first of all, at the cities of concentrated pollution by nitrogenous fertilizers, heavy metals, radionuclides and pesticides.

ANALYTICAL CENTRE ROSSA - THE NEW STEP AT THEWATER QUALITY CONTROL

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To organize the continuous drinkable water control, the supervision over the condition of the water sources, the estimation of the efficiency of the industrial sewage purification and other measures to conserve the natural resources, it is necessary to have a powerful analytical service. To solve the above problems, the Analytical Centre ROSSA was established in April, 1994 by the SE Mosvodokanal jointly with the French SOR-International company.

Today the Centre has a 2-year operational experience in performing analyses of drinkable natural and waste water over a wide range of physico-chemical and biological indices.

The organizational structure of the Analytical Centre, its outfit and the personnel make it possible to take, process and analyze approximately 3 thous. samples yearly by over 180 indices to be controlled in various types of water.

The technical competence of the AC ROSSA in performing analyses of drinkable, natural and waste water was recognized by the Gosstandard in 1994. The physico-chemical laboratory obtained accreditation in the Accreditation System of analytical laboratories (centres) while the microbiological laboratory obtained accreditation in the Accreditation System of laboratories of the State sanitary-epidemiological service of the Russian Federation.

The physico-chemical laboratory includes the following divisions: general chemical analysis sector, chromatography sector and spectrophotometry sector.

The microbiological laboratory is used for bacteriological, hydrobiological and parasitological studies of natural and drinkable water. The virulogical line is progressing.

The laboratories are outfitted with up-to-date analytical instrumentation and various auxiliary equipment. The Centre uses both highly sensitive, instrumental and traditional routine methods of analysis whose role in the analytical control of the water quality is important as before.

More attention is focussed in the Centre on the procedure of taking samples, to this end, a separate division (sector for taking and registration of samples) was established and functions now.

To ensure the reliable and accurate results of the analyses, the Centre uses a quality support

system which envisages the operational and statistical quality control of the results of the analyses.

The ROSSA is working for refinements in the methods of control: 14 methods are elaborated and metrologically attested, most of them are entered into the State Register of the methods admitted for use in the state ecological control.

The ROSSA is established as a practical analytical centre but the opertional experience has shown that there is a necessity to perform a large scientific research and to work on the methods of control: to elaborate and metrologically attest new metods of analyses, to improve the sensitivity and accuracy of the methods, to improve the efficiency of the sample preparation procedures, to process and generalize the results of the analyses, to refine the labor organization, etc.

Every year the AC holds seminars which attract specialists engaged in the water quality control where the urgent analytical problems are discussed. The last seminar was devoted to the problems of metrological support for functioning of the analytical laboratories.

The experience of operation of the Analytical Centre ROSSA may be of advantage where similar laboratories are to be organized. The Analytical Centre is ready to perform independent analyses of drinkable natural and waste waters as well as to render assistance in purchase of attested methods of analysis, in training of specialists and in consultations on the problems of the water quality control.

SOME PROBLEMS OF HYDRODYNAMIC MONITORING OF THE IRRIGATIVE SYSTEM

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In connection with wild development of industry, intensification agriculture acute necessity in conducting of measures directed to guard basin and in general, water resources come up. Although our country is rich of water resources however there is acute problem of water proviting in many districts. It is stipulated for distribution irregularity of water resources all over the territory of the country for years and seasons of year, for reguiments of the agriculture.

Water availability is one of main factors, influencing on the agriculture development. Great volumes of the water resources are used by industry for technological aims, requirement in water in agriculture increase, particularly for irrigation in arid zone for moisturing of drained grounds and for washing of solted grounds, because agriculture development in world scale came to the expanding of salinity soils, increasing of mineralisation and alkalinity of surface and underground waters.

Fight with salinization of irrigated land is actual problem, particularly in fields with arid, when irrigation is indispensable condition of guaranteed harvest of agricultural cultures.

Salinity soils is expanded on the all continents of Earth. Whole square of salt affected and in the world included expanding of saline and sodic soils, forms more than

950 mln ha. Hence there is importance of studding of f'ormation water-solt regime of soils as base of irrigated land optimal regimes regulation, operational control and rational water expenditure forecasting. Therefore questions of correct calculation, rational use and guarding of natural resources has great significance. Perfection of methods of hydrogeological and irrigative investigations is component part of wide program about quarding nature, including water resources, being realizated in our country.

Monitoring of natural processes is directed observations system, connected with solution of forecasting and management problem. In connection with above accounted necessity in creation of hydrodynamic monitor ing on irrigative systems as subsystem of soil monitoring which stipulated of irrational use of water resources. On the first stage of solution of the problems we consider worth while conducting of investigation for modelling of moisture and salt transfer in porous medium.

At present time whole square of salinity land in Azerbaijan 0.6 mln ha. Most part of these soils is in the low-lying districts. On these fertile land, crop capacity of agricultural cultures and particularly of cotton of primary and secondary soil salinits. Therefore increasing of crop capacity on these land must be provided by special irrigative measures, including drainage and washings. Fight with soils solinization best of all realizates by means of washing on the background of drainage. It is confirmed by world experience of washing conduction,building of hydrotechnical structures on the irrigated land's in different countries. The first question during capital washing in correct determination of necessary washing rate in dependence of one or other thickness of soils.

To present time the large number of works is connected with empiritic point of view in time of arrangement of calculating of washing rate. We consider more perspective elaboration of therotic methods of washing calculations (washing rate and time) based on modern ideas about physic-chemi-

cal and hydrodynamic particularities of salt dissolutions and its transfer in soil.

On base of equations system solutions, describing transfer in porous medium with boundary conditions we elaborated number of correct averageintegral dependence, permitting to decide as straight problems - water-salt regime forecasting, so reverse problems - identification of hydrodynamic parameters of model of soil salt regime. Some of these solutions are formed for engineering calculations. For the first time the methods of washing rate calculations in dependence on average salt content of soil thickness before and after washing were elaborated. Differences in determination of washing rate with accounting and without accounting of average assumed content of salt after washing (for example, according to formula of S.F. Averianov) can reach from IO to 50% in dependence of depth and degree of desalinisation of different soils Recommended formulas for washing rate calculation include filtration speed, physic-chemical particularities of soils and salts, as well as degree and depth of data desalinisation.

USING THE DATABASES FOR ECOLOGICAL MONITORING IN THE AREAS OF WATER BUSINESS INFLUENCE

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From the beginning of 1960 the intensive water using from Amudarya and Syrdarya rivers for irrigation accrues. In some years (1982, 1989, 1995 y.y.) the runoff of these rivers did not get to Aral sea. In small-water years (1985 and others) annual runoff did not exceed 5 km^3, in spite of average annual runoff of Amudarya river reached 65,9 km, and annual runoff of Syrdarya - 37,3 km^3. As a consequence of the deep and long-term environmental changes appeared serious breaking in the composition and structure of unique hydromorphique ecosystems in the Amudarya and Syrdarya river deltas. This changes touched a structure of the plant communities, their biological productivity, biomass storage and the ability to natural renewal. Water table left up, ground water mineralisation grows, chemical composition of soils changes also. In this situations of ecological crisis the monitoring of the natural biocomplexes within the two river deltas could allow as not only fix changes, occur both in vegetation, and in soils and so in ground waters, as well as forecast on the base available information these change.

For deciding the problems of ecological monitoring in the Laboratory of the terrestrial ecosystems dynamics at the IWP RAS database system was worked out. Structure of database was worked out for best involving, conservation and analysis the information concerning all the components of the landscapes (vegetation, soils, ground waters, microclimat, hydrological regime).

Main source information are given field studies, received by imployees a Labs. from 1978 to 1995 y.y. Information given from scientific publications and stock material from 1947 to 1984 y.y. were also processed and are enclosed as literary. At present it is kept more than 800 geobotanical descriptions.

Experience to usage has show that it contains available information possible:

- to control floristical composition for whole the region, with decryption the places where the species was met and frequency of presents;
- discovery and revision of ecological particularities of main species;
- an undertaking and quantitative analysis of floristical changes and classifications according different principles;
- to control and forecasting plant communities changes and its' ecological causes as in the direct ecological parameters and so in the area of ordination - in ecological scales;
- a revealing the changes in soils salinization, mineralization and water table of ground waters;
- a revealing a regularity between the track record of plant communities and ecological conditions of their habitats;
- biological diversity monitoring.

Work is executed on the UNESCO International project (509/RAS/40-Aral Sea), budgeted by BMFT of Germany.

MONITORING OF GROUND WATER QUALITY OF THE INDUSTRIAL CITY. CHEMICAL, STANDARD AND SOCIAL ASPECT

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The problem of supplying residents of Vladimir with high-quality portable water can not be solved in the near future because the existing surface water sources (the Nerl and Klyazma rivers) are regarded as highly contaminated ones. Besides the present

day water treatment technologies fail to improve the situation.

One of the alternatives to be used is the utilization of different ground and individual filters for water treatment and the use of water from springs and wells.

Sociological investigation carried out among the residents of Vladimir has revealed that one fourth of the population prefers to use portable water from springs and wells.

Monitoring of springs and wells was organized in town of Vladimir in 1991. It Aimed at giving estimates to ground water quality and investigating the technogenic influence on the town.

This investigation has been carried out by the movable laboratory of water quality coutrot of the Vladimir state technical university and the city sanitary inspection agency.

This work includinges systematic investigation of water samples in accordance with flat standard 2974-82 "Portable water" and influence of enterprises, transport and other utilities upon the migration of contaminants.

In the course of monitoring the areas close to water sources have been analyzed. The considerable number of data concerning water quality and dynamics of processes taking place their has been collected. It enables to put such questions before the city administration as law protection of catchment zones their certification and the problem of taking responsibility for sanitary-hygienic situation in the town.

As a result of monitoring some measures of environmental health of the town have been predicted. The members of the whole community and ecological movement should take part in it.

REACTIVE INDICATOR TOOLS FOR EXPRESS REFLECTOPHOTOMETRIC TESTING OF WATER

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The visual observation possibility of analytic signal of reactive indicator paper (RIP) is a dignity of analysis method with a express test on base of RIP, in the detection or a semiguantitave determination process of the component in a water medium on the sample taking spot.

A interpretation of this signal is maked difficult, that a subject factor of human vision is not taked into consideration and object criterions of the chemical indicator choice and a building of the standardt colour scale one used uneffective.

This stipulate for a unadequate of metrological characteristics of express test. A using of a "pocket" electronic reflectrometers allowed to raise a measuring precision of colour changes of a reaction zone of RIP. The metrological certification of reflectometric determination methodices of bismuth, iron, cadmium, copper, mercury, lead zinc, nitrate, nitrite ions and chlorine in water samples was carried out by means of a reactive indicator strips at the base RIP and indicator arangement of the set RIM TC 400-СП "И" 18-10-96-91 and reflectometer colorimeter MULTIECOTEST КНЖГ 414212.001 ПС with the using the processing program of experimental data, was composited in according with recommendations MI 6-09-32-88 "The execution order of the metrological certification of control methods of the composition of chemical reagents and special purity chemical substance" and was realized on IBM combined computer. The program is based on algorithms for the regression analysis. A contribution of systematic and accidental constituents to a sammary mistake was taked into consideration in according with SUST 8.207-76. Unlike ordinary applied programs the used program allowed to execute experimental data and on dissimilar dispersion in graduated points, but as well on different guantity of parallel determinations in individual points. The used in certificates methods reflectometer colorimeter was considered on SUST 8.010-80 "Methods of the measurings executing" in the capacity of auxiliary technical device, but in the capacity of the first measuring transformer is the active reagent of the prescription of a indicator paper.

It was settled in consequence of the certification, that metrological characteristics were for most methodics in optimal conditions of the limit permissible and dangerous concentrations measuring of controlled admixtures in the next limits: a permissible significance of the relative summary mistake - ± 30% on the confidential probability P=0,95. The relative difference between two parallel determinations is not exceeded 40 %. MULTIECOTEST retain in his memory the graduated dependencies of the optical density from the concentration for 8 test and provide wriding of new coefficient both of the above mentioned new test into nonvolatile memory. The determination mistake is stipulated for factors: a distinction of parties of RIP, light diodes and devices; a character of objects and conditions for a analyses, a technologist training.

AUTOMATION OF ENVIRONMENT LIMIT OF WATER USE

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Installation of limit of water use demands: identify status of water and wastewater systems proceeding from protection of water resources from exhausting and pollution; to analyse status of water source (on quality, quantity and regime) depends on exiting load on the water basin - rivers, lakes, reservoirs etc; determine possible consequences from connecting of exiting object on water status. If the consequences are material we must establish conditions of water use must be established (reduction of water intaken or wastes, increasing treatment levels, building reservoir etc.). In practice this work is very complicated because it is connected with information and metodics difficulties.

Information metodics software which were prepared by authors, may be used for solution of enumerated tasks and also for programs of its realization by means of personal computers. Programms make impossible to solve considerable problems. Programs includes of the following blocks:

1). Analysing of the technical level of water use on national economic object. It is intended for determination of an integral index of potential influence this object on the quality and quantity of water resources. Program software are combined with the system of state water cadastre. The program can be used to analyse an ecological estimation of present and future technologies, water economic systems and buildings; it's also necessary for registration, planning and project of water use at the different stage of national economy management.

2). Estimation of the water resources and level of their use which is conducted above the place of the planning of water use, where making more precise of water resources is determined. Water economic balances in month and year developed there. The result is used for the determination of influence of this water user on quality characteristics and water regime. The ecological limits are also taking into consideration.

3). Determination of water quality in stream in the place of planning water use. In includes the examination of integral and differential water quality indexes on the data of Hydromet station measures. Instream reaction rates are taking into consideration during the estimation of wastewater discharges. Metodics and programms of this block to evaluate single and multiply discharge impact on receiving streams, lakes and reservoirs and determinate discharge limits and concentration of pollutants.

All programs are easy to adapt for exact as a whole as a partly.

METHOD FOR EVALUATING THE DEGREE OF POLLUTION IN WATER RESERVOIRS ON EXAMPLE OF UDMURTIAN SMALL RIVERS

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Evaluating the ecological status of water reservoirs comprises a number of physical, chemical and biological measurements, that can be performed by the means of water samples analyses. Proper and reliable interpretation of the results of such an analysis presents a complicated task.

Current ecological and sanitary-hygienis status of water resevoir depends on a big number of factors, including those possesing an occasional nature. Schedule of sampling may also influent the results of any analysis. Usually an inventory of the checked parameters in not quite sufficient for obtaining a satisfactory result.

All above-mentioned reasons account for the necessity of developing the monitoring methods for water reservoirs, that shall meet the following requirements:

- Reliability of evaluating the pollution^s nature and degree in a water reservoir.
- Trustiness of identifying the source of pollution.
- Cheking a minimum number of parameters, necessery for reaching the goals mentioned in points 1 and 2.

With the purpose to meet all above-mentioned requirements we introduce a method for evaluating the ecological status of water reservoirs, based on a certain algorithme (or in other words on a sequence pf operations):

1. Investigation of the local hydrographic system; Studying appropriate archives; Choosing the area for subsequent sampling.

2. Water electric resistivity metering in the chosen areas and identifying the areas possessing an exessive resistivity; Creation of precise scheme of resistivity metering for subsequent plotting a diagram of the resistivity alterations.

3. In order to check, if the pollution is a temporary or a permanent one, the Oligochaeta ratio in macrobentos is to be determined in the areas possesing an excessive resistivity. By the means of the

above-mentioned analysis an exact location of the pollution areas can be fulfilled.

4. To evaluate the pollution^s nature in a water reservoir, concentration of oil products on the reservoir^s bottom is to be determinated. Judging by the results of those analyses, a source of the permanent pollution can be identified and located as well.

By comducting a complex of surveys in comply with above-mentioned sequence one can promptly and not expensively outline the major regularities of the water reservoir^s pollution. Besides that, basing on the acquired results one can envisage the necessity of conducting more complicated and more expensive analyses like determining the concentration of heavy metals, and organic substances, etc.

The method has been verified on example of two small rivers located of the territory of Udmurtia - the Vala and the Votka, whose pollution sources much differ from each other (agricultur and industrial, respectively). Application of the present method has allowed us to evaluate the pollution^s nature and degree, and also the major pollution^s sources in the surveyed rivers in a two-week term.

ECOLOGICAL MONITORING OF HEAVY METAL IONS IN WATER BODIES

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Heavy metal (HM) ions are the most widely spread and dangerous pollutants of natural water bodies. Often their concentrations in water bodies exceed tenfold the limit of admissible standards. And even if the conventional random water samplings do not show and excess of the standards, it is quite possible to have a local exceeding because of salvo disposal of industrial waste water, nonuniform arrival of waste water, which has the HM concentration even below the standard, is accompanied by accumulating HM in a biosystem of a water body. In these cases the results of analysis offish organs and tissues may give indirect evidence that the state of a water body is not well-being. These investigations are based on the ability for accumulating HM by fish organs and tissues which provide natural indicators. That is why one often comes up against the events of sizable exceeding of admissible residual concentrations of HM in fish while there is no practically HM in water samplings. The extended prospects for realizing continuous ecological monitoring of water bodies are being opened up by using special sorbent which is able to accumulate pollutants contained in water. At the moment there are lots of materials which are capable to absorb HM from water. In deciding on the best suited sorbent we were guided by the following main principles. The sorbent should: possess high sorbing capacity and hold HM sorbed rather fast; be accessible for application and not produce secondary pollution of the environment; possess high durability and resistance to environmental influences. These demands are satisfied by nitrogen-bearing fibrous materials based on polyacrylonitrile which are fibers type of glypan. They are ampholytes and are capable to sorb HM without regard to their state in water according to the cation-exchange and anion-exchange mechanism. They are also capable to hold colloidal forms of the metals in pores and microcavities of the fibers by Van der Waals forces. As a result of the investigations made it has been found that the chosen sorbent is actively taking up ions of hydrargyrum, cadmium, cuprous, plumbum, zinc from water. An apparatus based on this sorbent has been designed. The apparatus enables to obtain quantitatively new information of the actual state of a water body over a long and continuous period, that is practically impossible for conventional random water samplings. The apparatus has been full-scale tested on a set of water bodies and has exhibited high technical possibilities.

"Provisional Instruction for Application of Apparatus to Monitoring Heavy Metal Ions in Water Medium"(St. Petersburg, GosNIORKh, 1995).

ECOLOGICAL MONITORING OF HYDROGEOLOGICAL PROCESSES AND THE SYSTEMS IN THE ARAL SEA BASIN

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The technogenetic effects on the environment of the arid zone, even though insignificantly influencing either components of its ecosystems, are sure to affect the regime of the subsurface hydrosphere and demand the estimation and the forecast of the

results, as their integral value may be both positive and negative.

The estimation of the state and the forecast of the ecological-hydrogeological processes (EHGP) and the systems (EHGS) is carried out within the framework of the ecomonitoring at the specially chosen proving grounds witching the limits of the territories manifesting the greatest sensitivity towards the anthropogenesis. These undoubtedly are the territories of the ancient (Kzyl-Orda) delta and the modern (Kazalinsk) one the of the Syrdarya river and the irrigated massifs of its bases, and also the drying bottom of the Aral Sea depression (hollow).

The objects of the ecomonitoring were chosen taking into consideration the reception of the picture of the structure and functioning EHGS on the trends of the greatest changeability of its biotic and abiotic subsystems on the a is of the base indicational characteristics, i.e. the level, the mineralization and the chemical content of the subsurface water including the microcomponent, isotope and gas content, pH, Eh and the temperature; the salting of the soil-ground a of the aeration zone, the filtration and migratory parameters, the fluctuation and the succession of the main plant associations, their transpiration and massdynamic parameters in interrelations with the underground water regime considering the compulso y use of the aeroastronautics information.

The diverse complex of the technogenetic influences on EHGS and EHGP in subdivided in a number of types according to the character and the ection of the energy-mass-transfer, as follows: 1- the technoexogenetic one connected with the introduction of the material and the energy into EHGS; 2 - the technoendogenetic one connected with carrying out the material and the energy; 3 - the mixed one. Hence, the natural and the technogenetic EHGS are the open thermodynamic systems, and, being a par of the environment, actively respond to the all kinds of the effects of the natural and technogenetic character so as to weaken them by transforming into new quality quasi-equilibrium states in conformity with the principles of the synergetics of the geological and ecological systems.

The state and the technogenetic evolution of EHGS occur determinately between the points of state transforming, were successfully modeled and may by regulated through models, including these on the constantly acting base.

The biotic subsystem of EHGS is characterized by the greatest instability at the points of the transition (bifurcations), and the evaluation of the further direction of its evolution may be done basing only on the probable (stochastic) foundations.

So, the main abiotic factor of forming and functioning EHGS is the regime of the underground, chiefly, ground water in the arid conditions of the Aral Sea region, the other components of the biotope being more steady. There fore, we have confined ourselves only to the regime of the underground water and the connected with it flora on the geobotanical level (without the detailed analysis of the biocenosis components) following the prognostic aims.

MONITORING-BASED NUMERICAL MODELING OF WATER QUALITY IN SANITARY-PROTECTION ZONES OF SARATOV RESERVOIR

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Increasing degradation in the quality of inland surface waters necessitate the development of adequate methods of operation control, assessment and prediction in the spread of pollutants as recorded in the process of monitoring or any other field observations. The water depth in man-made impoundments is known to be heterogeneous in terms of its pysico-chemical composition and a complex hydrological structure depending upon the number of its constituent water masses.

The survey of spreading pollutants over the Saratov reservoir as a result of wastewater discharge from Togliatti, Saratov and large tributaries (Sok and Chernikha rivers) shows that the existing heterogeneity of the water masses is conditioned by dynamic processes occurring therein.

Operation prediction can preferably (and sometimes solely) be effected based on mathematical modeling. Moreover, the amount of feasible modes of transformation and mixing generally exceeds the amount of actual situations to be found in water management and nature conditions.

A series of investigations was conducted within a section of the Saratov reservoir starting from the Togliatti wastewater outfall downwards to the Samara water-abstraction including the lifthand tributary (Sok river) and nearby environs. Modeling was effected based on a CARDINAL applied program intended for diverse hydrodynamic and hydroecological tasks.

Field observations on the dynamics of spreading wastewaters were carried out, using a HYTHON information-measuring system aboard a boat. The index of specific electoconductivity characterizing the total extent of water mineralization was taken as a major parameter in the assessment of dilution and transformation of wastewater inputs.

Out observational results, as well as data on variations in the water discharge and surface level enabled to compile a mathematical modes with identification parameters. Computations were based on the use of equations of long-wave dynamics, the so-called equations of "shallow water" and a semi-empiric equation for the computation of spreading

impurity. These initial equations were adapted to curvilinear co-ordinates which approximation towards the boundaries of the zone involved is fevered by its intricate configuration.

Our field observations and modes computations for the Togliatti-Samara section of the Saratov reservoir were aimed at assessing the nature and location of pollution zones in the vicinity of the Samara water-abstraction. Computations were made both for calm weather conditions and in case of winds of different directions. Adhesive tension of the wind was found out to be the principal factor influencing the way of mixing the wastewaters. South- and south-west winds, typical of this region, enhance the friction against the bank and, thus, increase the water turbidity at the site of water intake plants of Samara.

The results of numerical computations have appeared to be strongly consistent with those of the field observation.

During field observations a need often arises on an effective estimation of measurements for the introduction of timely corrections into the course of experiments. So the modes suggested can be used as a computation-measurement one, say in the HYTHON complex. This will enable to arrange investigations in a strict accordance with the preset aims. Numerous applications of this mathematical modes for the given region favor the feasibility of its use as a prognostic one for the water purification management at the water intake and purification sites. The examination of modeling and field observations has enabled to elucidate peculiar features in the formation of the pollution zone throughout the water area of the Saratov reservoir.

SCIENTIFIC FOUNDATIONS FOR SANITARY-PARASITOLOGIC CONTROL OF DRINKING WATER QUALITY

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Epidemic safety of drinking water in our country are regulated by bacteriological indicators (GOST 2874-82. However, the contamination of drinking water by parasitic deceases exciters (gelmint's eggs, cyst lamblii, oocyst cryptosporidii) , which are more stabile than viruses and bacteria to influence of physical and chemical factors of environment and also to desinfection reagents (chlorine, ozone) used in water treatment facilities, is more dangerous. Therefore, as notes Graun Gunter (1984), in most cases the transfer of lamblioz is done through the water, which satisfies standards by bacteriological indicators.

During last decades many flashes are related with cyst lamblii and oocyst criptosporidii has been fornd in drending water. Thus, in the USA from 1971 till 1985 are registered 502 flashs of deceases related with water. In 52% cases it was related with lamblii, 1 flash - with cryptosporidii (117 cases) and 1- with amoebas (14 cases) (Graun et. al. 1988). Flashes of critical enteric deceases invoked by drinking water infected by cyst lamblii were marked in England (69 cases, Browinig S.R. et.al. 1988), Canada ((Isaak-Reiton Lud. 1987), Poland (Pawlowskij Z. et.al. 1987) and in many developing countries.

In March, 1970 was marked the flash of lamblioz among foreign tourists (45 cases) in the St. Petersburg caused by drinking water according author's opinion ((Kettis Agneta Anst et.al. 1973).

The main symptom of those deceases if diarrius which according the dates of World Band of Reconstruction and Development makes the major lossesglobally (lost of more than 99 millions of man-years - Dali).

In our country the factor of parasitic pollution of water sources wasn't being taken into account as for control of drinking water and water of surface sources quality, as for selecting of water treatment and desinfection methods in water stations, in spite of increasing of population deceases of critical enteric infection (unknown ethimology) from 300,5 in 1992 till 308,7 per 100,000 in 1994 and lamblioz - from 45,26 till 92,07 per 100,000.

In such situation sanitary-parasitological studies of drinking water, surface and underground water sources in Astrakhansky, Moskovsky, Leningradsky, Grodninsky (river Belarus), Kzyl-Ordinsky (Kazakhstan) and other regions were very aclual.

It is found that in several regions of Russia and CIS-countries drinking water according parasitic indicators is unsafe for people health, because from 333 samples 30 (9%) were consists of cyst lamblii. In surface water sources parasitic decease exciters were found 79,9% and in underground water - 4%. Water infection by gelmint's eggs and enteric parasitic protozoa cysts is getting by drops of waste water, surface flowing off and liquid manure, consists in 96% of samples mentioned above parasitic agents.

Materials of studies has been used as basis for checking of quantity criteria for parasitological quality indicators of drinking water, which provides it epidemical safety (Table).

Table. Parasitological indicators of drinking water safety.

Indicators	Measure units	Normative
Enteric pathogenic protozoa	Quantity of cysts in the 50 liters of water	Absence
Celmints (eggs and larva)	Quantity of eggs and larva in the 50 liters of water	Absence

Including of mentioned quantity criterias for parasitological indicators into new projects of sanitary rules and normative "Requirements for drinking water quality in the centralized water systems" and GOST "Water Quality. Drinking water. Quality control." allows to increase effectivity of the control for drinking water quality and also provides reliable protection of people health.

PLANNING CHEMICAL ANALYSIS FOR MONITORING CONCENTRATION AND FORMS OF HEAVY METALS IN NATURAL WATER

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Heavy metal ions and compositions are one of the most widespread groups of toxic substances polluting natural water. These substances are conservative - they possess enough physical and chemical potential to become part of different compositions and to exist in various forms under changing environmental conditions. Heavy metals may accumulate in suspended particles, in bottom sediment and in the biota. They may return to the water media at massive scale, causing secondary pollution and telling badly on the water environment. It is necessary not only to measure total share of heavy metals in natural water, bottom sediment and aquatic organisms, but to reveal the laws of interaction between heavy metals and other components, both organic and mineral. The plan for researching the composition of natural objects suggested by the authors includes the following analytic methods:

– the method of chemical phase analysis by means of eluating with selective extracting agents for detecting heavy metal forms in bottom sediment;

– the method of separating dissolved heavy metal forms in natural water according to the sign of their charges - the forms are divided into acid, basic and neutral groups;

– the method of atom emission spectroscopy with induction-engaged plasma and electric are used as excitation sources for detecting mineral components in natural water, bottom sediment, suspensions, seaweed and sorbents employed for separating mixed heavy metal forms;

– the method of atom absorption spectroscopy with flame or electric heater atomizers used for detecting heavy metals in natural water, extracts of the bottom sediment and sorbents;

– the method of pyrolytic has chromatography for determining total share of organic carbon, free carbon-hydrogen compositions and heavy volatile carbon-hydrogen substances;

– the method of Fourier infrared spectroscopy for monitoring molecular changes in the bottom sediment and suspensions under changing conditions;

– the method of detecting heavy metal forms in macrofits and the bottom sediment with shining-through or raster electronic microscope.

Each of these methods yields certain information about specific features of heavy metals migration in biochemical cycles. Using the suggested complex of analytic methods allows to determine accurately the contents of heavy metals in these media without resorting to hard and complicated refining methods that very often produce additional systematic errors, The complex of methods suggested here has been tested during research words on Ivankovo and Kuybyshev reservoirs. It allowed to estimate dependencies and kinetics of heavy metal phase transformations and to identify certain classes of organic substances in the bottom sediment and extracts from it. So it became possible to estimate the part these organic substances play in heavy metal phase transformations within the system of water and bottom sediment. There are reasons to assume that the major part of organic substances in the bottom sediment is not involved in mass transfer between these two media and promotes the cumulating of heavy metals in the bottom sediment. The heavy

metal forms detected in superior species of seaweed allow to estimate the probability of their transfer into water solution when the plants die during the fall and winter seasons. The measurements show the presence of many metals in seaweed in the form of minerals or isomorphic admixtures in other mineral crystal grids. The methods suggested here allow to estimate elementary composition of amorphous micro-particles and reveal radio-active isotopes. Using the suggested complex of analytic methods allows to clarify the peculiarities of heavy metal distribution between water media, the bottom sediment and the biota, and to estimate probabilities of elements transfer from one phase into another.

MONITORING OF WATER MEDIUM IN MIDDLE PART OF THE VOLGA RIVER

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Phenol and its derivatives are the most widely spread components of natural water. Such derivatives of phenol as pentachlorophenol, 4-chlorotrimetylphenol, 2,4,6-trichlorophenol do not enter biological circulation. Near very low concentrations (-10 μg/l) produce a toxic influence on the organisms inhibiting water.

The present paper in the result of 1.5 year study proposed for evaluation and determination of the chlorophenol contents in the middle water of the Volga river.

Contents of chlorophenol derivatives in Volga water near the Kazan are the next: 2-chlorophenol - to 30 maximum permissible concentrations (MPC), 2,4,6,-dichlorophenol to 4 MPC. Pentachlorophenols are the most toxic in biological test. We analyzed species of the Volga water with helpingbio test method for the additional estimate its quality.

The data obtained leads to conclusion that the Volga water near the Kazan water scoop does not exhibit high toxicity. Chronic toxicity was determined with the aid of Daphnia magna as a bio test, which was detected in the pot water only once.

Almost all tests of the Volga water taken below the draining system of sewerage contained phenol and its technogenic derivatives, amount of considerably MPC of phenol, dichlorophenol and pentachlorphenol mainting up to their 33, 83 and 13 values, respectively.

When running father from the place of the waste waters outburst, contaminated sewerage gets transformed and diluted with the Volga water and the phenol content becomes much lower.

However, even 2 km far from the city, two of the toxicants under study were detected in the amounts of 30 MPC (phenol), 26 MHC (2-chlorophenol) and up to 16 MPC (tri- and pentachlorophenols).

A METHODOLOGICAL BASIS FOR THE EVALUATION OF THE POLLUTION OF WATERBODIES AND THE POSSIBILITIES OF THEIR PURIFICATION (FOR THE AZOV AND BLACK SEAS)

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One the most urgent tasks of nature protection is the need to improve methods for determining the character and levels of pollution in various waterbodies. The information on the controllable elements of aqueous ecosystems, the composition of pollutants and the spacio-temporal resolution of the parameters being observed is limited and not representative enough. This fact makes it possible to adequately evaluate and reliably predict character and level of pollution.

The reliability of such estimation and its compatibility with the type and scale of economic activities in the Azov and Black Sea Basin should be improved through inclusion into monitoring programs of the following:

- the elements of the aqueous ecosystems that carry the most useful information (water environment, bottom sediments commercially valuable fishes and the organisms on which they feed);
- the pollutants most widely used in the basin area which represent a particular threat to the health of people and fishes;
- zones of shallow water subjected to anthropogenic pollution;
- areas where stocks of fishes accumulate during the most important biological cycles (spaw-

ning, the period when fry migrate into the sea, gaining of weight etc.).

Studies of the pollution of the Azov and Black Seas conducted during many years and in accordance with the improved programs of monitoring allowed one to evaluate the present-day state of the marine ecosystems.

In comparison to 1970-1980s in the Azov Sea there has been observed a certain decrease in water pollution by typical toxicants, which is explained by a reduction of industrial activities in the Basin.

Over 80 % of mineral oil products and more than 90 % of metals present in the marine environment have been found in the upper layer of bottom sediments, while the content of anthropogenic toxicants in organs and tissues of commercially valuable fishes exceeded manifold their concentration in water.

According to our estimates, the levels of pesticide pollution in the Azov and Black Sea in regard to the composition and the total content of toxicants are several times higher compared to the data which take into account no more than 5 pesticides of the "global cycle".

Annual and seasonal variations of the content of pollutants in the marine environment indicate a high self-purification possibilities of the sea. This fact is a basis for the restoration of the marine ecosystem which is in principle feasible and can be achieved through a reduction in the amount of pollutants entering water capable of accumulating and negatively affecting the environment for prolonged periods.

CONTROL OF THE WATER QUALITY BASED ON THE STATE OF THE GENETIC APPARATUS IN OBJECTS OF THE AQUACULTURE

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The pollution of the environment adversely affects many technological processes, for example, in the field of the aquaculture.

One of the most complicated problems is the protection of the aquaculture technologies against the background pollution of waterbodies with commercial fisheries by small doses of xenobiotics. Our studies are concerned not only with purely theoretical ecological questions but are also aimed at the development of measures that could protect aquaculture objects against pollution.

The present paper evaluates alterations in the frequency of the chromosome aberrations (Cha) in eggs and prelarvae of Russian sturgeon; furthermore, a number of genotoxicological and biophysical characteristics were studies of the water supplied to the hatchery in Rogozhkinskoye fish farm (Rostov region) where the unit of the sorptional purification was tested.

The experimental evidence from the purified (experiment) and polluted (control) water has revealed the specific reaction of the progeny of different specimens.

In experiments on genetically unhealthy progeny the Cha frequency increases for the control to 34.9 %.

In this experiment the percentage of the lethality of the poorly developing eggs increased resulting in a lowering of the Cha frequency to 21 %. In another experiment the Cha frequency decreased from 25 % to 17 %.

For batches of more or less sound eggs the Cha frequency values in control and experiment do not differ substantially remaining within the 21 -22 % background level. However, the survival of the eggs increased in purified water. Chemiluminescence data point to an activation of the free radical processes in purified water.

All chemiluminescence data exceeded the corresponding control values. In spontaneous chemiluminescence the excess values amounted to 11-155 %, for rapid flash 35-47 %, for slow flash 14-35 % and for tg a 50-203 %.

Thus, the results obtained allow the following conclusion to be drawn: the elimination of genetically unhealthy specimens at the earlier stages of ontogenesis and the improvement in the qualitative and quantitative parameters of the growing fry are related to the activation of free radical processes generated by the purification of water.

THE METHOD OF PREPARING OF WATER SAMPLES FOR CHEMICAL ANALYSIS

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The main difficulty of nature water analysis consist in phenomenon of elements escape from the volume to walls of bottles. To prevent the big errors the procedure of double filtration were developed. The first filtration separate the suspensions with the metals sorbed on them. It accomplish as sun as possible after taking a sample. Due to sorption come to satiation the bottles fill with the samples water the day before. After the first filtration 8-8 dichinolylsulfide is added and the second filtration

takes the solutable form of metals. The whole output is 93-98%, that was enshured in experiments "is introduce - is finded".

This method was used during last 15 years in several regions of Russia to determine the contaminations of heavy metals in drinking and natural waters as well as in snow samples with errors about 15%.

FORMALDEHYDE DETERMINATION IN INDUSTRIAL WATERS AND SEWAGE WITH THE HARD-BODIEN MICROELETRODE WORKING IN THE INVERSIONAL VOLTAMPEROMETRIE CONDITIONS

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Formaldehyde is a toxic compound [1] and so the task of control on the formaldehyde content in the objects of the environment pariailarly in wastewater and industrial water is very important for the nature protecting organizations.

There are some methods for formaldehyde determination in the industrial water and wastewater [2,3,4]. Nowever these methods suffer from grave shortcomings such as a relatively low sensitivity, poor selectivity and labour intensiveness of the execution.

We have developed a method of formaldehyde determination in the industrial water and in the wastewater by means of the hard-bodied graphite microelectrode working in the inversional voltamperometric conditions. We fulfilled the determination by using a universal polarographe PU-1 in accordance with the following methods: we took an amount of 5 ml of the tested sample and added 10 ml of 1 M LiOH. Then we registered volamperic curves at peak potential of the reduction of formaldehyde of 1,7 V relatively to the chlororgentum electrode; the initial voltage was 1,0 V; scanning velocity was +0,1 mU; scanning amplitude +0,4 mU.

Registration time of volt-ampere curve was 3 s. A graduated graph was used to calculate formaldehyde concentration.

It is shown, that acetone, aldehydes, alcohols, hydrocarbons, nitrogen oxides and ammonia. Don't disturb the determination of formaldehyde. The limit of formaldehyde detection in water is 1*10-4 mg per 1 (upmost admissible concentration of formaldehyde is 5*10-2 mg per 1).

We fulfilled the comparative test on the sensitivity and results reproduction at different polarisation conditions of electrode (constant current routine and alternating current routine). The sensitivity in alternating current routine is higher by an order.

It is proved that the present method has a higher sensitivity and a reduction (not less then 4,06 %), a selectivity and short of determination in comparison with photometric [2] and polarographic [3] methods as well as thinlayered chromatography [4].

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CHEMILUMINESCENT PROBE FOR ON-LINE MONITORING OF WATER QUALITY BASED ON MAGNETIC FIELD SPIN EFFECTS

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The role of chemiluminescent techniques in analytical chemistry is well known. Incredible sensitivity and convenience of detection are the major advantages of these techniques. The main disadvantage of the techniques is their low selectivity.

New opportunities to improve the selectivity of analytical methods based on luminol chemiluminescence (CL) in water were recently found. They are based on the discovered sensitivity of the rate constant of one of the elementary stages of this reaction on weak magnetic field [1,2]. Experimental procedures employed in this work are typical for the new scientific discipline "Spin Chemistry" [3]. The technique created is protected by patent [4].

The action of the magnetic field on a chemical reaction reveals in two different ways: as a change

of CL intensity in constant magnetic field, and as a time delay of millisecond range between the alternating magnetic field and the modulated CL intensity.

All the three parameters measured, namely CL intensity, amplitude of its modulation, and time delay between the alternating magnetic field and the modulated CL intensity, are strongly dependent on the concentrations of different substances dissolved in the water, such as some metals (copper, iron, chromium, silver, etc.), oxygen, oxygen radicals, hydrogen peroxide, chlorine, some organic compounds. The sensitivity of the method enables one to detect impurities given in concentrations from several grams to several nanograms per liter.

The device designed on the basis of this method can be used as an autonomous remote element of a widely spread system for monitoring various water flows. The principle of operation of this device is the following: the water being examined is permanently mixed with luminol solution in a flow optical cell, the CL arises and then its intensity is modulated by the alternating magnetic field. Compact electronic arrangement detects three parameters: CL intensity, amplitude of CL modulation and the time delay between the alternating magnetic field and the modulated CL intensity. The information obtained is treated by the programable controller and is transmitted via modem and phone line to the central computer placed in the organization controlling the given area. In the case of abnormal change of any of the parameters controlled the system operator will be informed about that within one minute and simultaneously the automatic sampling could be performed in order to make the detailed analyses of the accident by standard analytical methods later.

Once the water impurities composition is known, the device could be calibrated according to the concentrations of definite substances. If the water impurities blend is not known, then the CL intensity could be used as an integral parameter sensitive to the large amount of substances.

The device may be constructed as a crate with several modules which can detect besides the above mentioned parameters other important characteristics of the water: pH, luminescence, radioactivity, etc. Employment of flow gauges will enable one to estimate the amount of hazardous impurities poured out into the water flow.

The device does not contain any expensive supplies and requires cheap chemical consumables with low day consumption. One technician would be enough to serve several such probes located at different sites of a city.

A set of these devices may be organized as a network with definite hierarchy. Central display console can promptly receive and treat information from a large number of probes spread over a wide area.

Thus, the major advantages of the device are:

- possibility to use it in a system for permanent monitoring;
- possibility to create a spread network to control a wide area from the central display console;
- wide spectrum of substances detected;
- extreme sensitivity of the method;
- possibility of complex analysis of a number of chemical and physical parameters of the water;
- low cost of the device and its maintenance.

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MEDICO-ECOLOGICAL PROBLEMS IN WATER MONITORING OF THE REPUBLIC BURYATIA

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As it is known, the main criterios, which reflect aggravation of population's health and which are features of sick rate, death-rate, life duration, changes of physical development, immune status and reproduction function. They are in elose connection with the condition of the environment. The deficit of a clean, drinking water for the latest decades that brought to bottling of the Baikal water due to industrial usage, so that makes necessary medical investigations of the local population, inhabiting the vicinity of the Baikal lake.

We made a few clinical examinations of the children in Kamensk, which is badly ecologically influenced by Selenginsk cellulosecarton works, shifer and asbestos-cement plants. Examinations included complex issues, concerning the conditions of drinking water use in the settlement and a possibility to restrict it under the influence of antropogean factor. The examinations find out the ways, how hygienic and biological peculiarities affect the organism of minimineralised waters. Examinations also show the interrelation between man's organism and agents of a disease of alimentary origin.

According to individual approach to every child, all the examined, on the basis of Health Protection Ministry recommendations were divided into following groups:

1. those, appropriate to normal level of principal health function - 21%.

2. those, considered to be healthy, but having some functional or morphological deflexions and reconvalenses after acute diseases - 48.5%.

3. those, suffering chronical diseases in condition of reconciliation of functional abilities - 24.4%.

4. those, suffering chronical diseases in condition of subcompensation with diminished functional abilities - 6.1%.

As results show, there are not great differences between the mentioned groups in comparison with the same groups on the whole in the Russian Federation.

INTEGRAL SORPTION METHOD FOR ANALYZING NATURAL AND WASTE WATER QUALITY: PRINCIPLES AND OPPORTUNITIES OF ABRUPT POLLUTION IDENTIFICATION

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Natural water quality monitoring is vital for environment protection. There is a tradition of developing automatic instruments for current quality analysis. However creating such systems is still a problem. These systems are too expensive, and there are no sensors accurate enough for many admixtures, such as heavy metals.

New Integral Sorption method is suggested for monitoring natural water chemical characteristics. The method is based on permanent flow of small amounts of natural water through a Sorption tube. Specialized sorbents are selected for different toxic admixtures, such as heavy metals for example. The Sorption tube may be assembled of several parts. After some period of sorption the tube may be taken apart for scanning the sorbet distribution or for desorbing each part. The total quantity of admixtures in the water is determined. Besides. by solving relevant mathematical problem, it is possible to determine the dependence of admixtures concentration on time.

The concentration of the components sorbed increases, so the analysis of toxic admixtures in the desorbed substance becomes easier. The desorbed substance composition is determined by relevant methods of chemical analysis. For example, atomic absorption method is used for detecting heavy metals. If the Sorption characteristics (the amount of the sorbet, the flow rate through the tube, the exposition period), the components analyzed are sorbed in the tube almost completely.

With given physical and chemical conditions of sorption (isotherms and sorption kinetics), a mathematical problem emerges: sow to determine varying concentration of a component at the tube inlet (hence in natural water) basing on the component distribution along the tube. Solving that mathematical problem is hindered by principal difficulties because the problem belongs to the class of illposed problems Small deviations of distribution along the layer caused, for example, by measurement inaccuracies may bring big changes to the solution.

To obtain stable solution, regularization method is necessary. Practically, pollution is often of abrupt character. Because of that, we shall seed the solution in the form of a delta-functions sum.

When solving the Inverse problem we shall assign a number N of abrupt peaks of pollution. Then set of parameters $\mathbf{p}=\{u_0, q_l, t_l\}$ is a compact in a space of dimension 2N + 1. So parametrized, the problem becomes a correctly posed one.

For defining the parameters of **p**, a discrepancy functional is used. Then a variation problem is solved to obtain values of **p** delivering minimum to the discrepancy functional. For that, it is necessary to find the number of abrupt pollution peaks N, the background level u_0, the capacity and the time interval of peak #i. This functional is not a convex one, so the problem of seeking **p** is a multiextremum problem of non-linear programming. For solving that problem. algorithms were used based on Newton's methods and methods of needle variations.

The modes calculations carried out show that N abrupt pollution peaks may be detected distinctly enough if the number of tube sections is not less than 2N. In the case considered here with 10 sections, the number of identified abrupt pollution peaks should not exceed 4 or 5. Besides, pollution peaks cannot be distinguished from each other if time interval between them is less than the interval during which a peak passes through a section.

If the rules mentioned are abided by, the algorithm presented here for solving Inverse problems within the framework of integral sorption method allows to detect abrupt pollution peaks, their number, capacity and time interval.

MONITORING BENZ(A)PYREN IN VOLGA AND OKA SURFACE AND DRINKING WATERS ON TERRITORY OF NIZHNY NOVGOROD AREA

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According to theory chemical carcirogenesis significant role in development malignant melanomas belongs polyadic hydrocarbon benz(a)pyrene (BP), which WHO has named "as the indicator of oncological danger".

For effective struggle with this danger the systematic control of BP in environment and at first in surface drinking waters is necessary.

The successful fulfillment monitoring of toxicants in environment is possible only when the executor has metrological supplied operative analytical technique. Voltametric of organic connections, based on reaction of electrooxidation on carbon electrode, is a new and perspective direction of analytical chemistry. This method was used for monitoring BP in surface and drinking Volga and Oka waters in area of Nizhny Novgorod, as simple on performance, express and correct on metrological characteristics.

1994-1995 years systematic determination of mass concentration BP by voltametrical method in surface and drinking waters on water pipe stations of N.Novgorod, Bolakhna, Pavlovo, Dzerzhinsk, Bogorodsk was executed. It was carries out 756 analyses.

During monitoring was not observed of uniform case, when normalized on MEC=5 ng/dm^3 (maximum emission concentration) the concentration BP in surface waters was less than 2. The share of tests with BP in terms of MEC from 2 up to 10 in Volga waters from Bolakhna up to of N.Novgorod and in Oka waters from Pavlovo up to Bottom N.Novgorod was increased from 10-20% up to 50-60%. The high contents BP in surface waters Volga and Oka is explained BP crossborder transfer from industrial areas located above on current of the rivers, industrial emissions by the numerous enterprises and hits in waters of soot of ship engines. A large role plays the pollution of atmospheric air. Periodically in measurement's situations were observed increasing concentration of BP by 10 and more time that speaks about availability emergency industrial emission.

The analyses of tests of drinking waters prepared from surface Volga and Oka waters on water pipe stations have shown that the technology used by them much reduces the concentration of BP in drinking waters. The tests of drinking water on all stations with BP 10 MEC have made only 5%, that in ten times it is less than in appropriate surface waters. Though in one test of drinking water the contents BP was not less than or equal to MEC, however 6-9% of tests had MEC not more than 2, 60-70% of tests contained BP in quantities from 2 up to 6 MEC, 10-20% - from 6 up to MEC. The poor quality of drinking water was compelled Administration of N.Novgorod and area within the framework of program "Pure water" to establish in children's establishments, hospitals with aim drinking water local cleaning.

Whole above-stated is urgent claims organization of the operative control of presence BP and other toxicants in surface waters and industrial emissions.

THE USE OF THE MASS-SPECTRAL ANALYSES FOR THE ENVIRONMENTAL PROTECTION

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The environment (atmosphere, soil, water) contains today substances of different nature and origin in a very wide range of concentrations and with quite different effects on the nature. To control the content of these substances in different media, the use is made of various analytical methods. Mass spectrometry may more preferable than the other methods for study and quantitation of the content of these substances in a matrix.

At present, a great experience has been gained concerning environment pollutants. The concentration of pollutants can be on the level of trace concentrations, i.e. on the level of ppm, ppb, or ppt, while the threshold sensitivity of most mass-spectrometers is on the ppt level.

Information about environment pollutants is also useful for making standard reference materials necessary for calibration of any analytical method, including mass-spectrometry. Today standard reference materials for various applications have been developed and are used to solve different problems using mass-spectrometry.

Only standard reference materials for control and calibration measurements can really ensure the absence of the systematic measurement uncertainty. To solve the problems of environmental measurements, it is necessary to increase the variety of standard reference materials.

DATA BASE AND INFORMATION RETRIEVAL SYSTEM "WATER. ANALYSIS"

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Data base and information retrieval system "Water. Analysis" was made on the base of complex treatment of the publications from the VINITI Abstract journals. Data base is documentary and factual and has the information about the methods of Earth hydrosphere analysis (seas, rivers, lakes, underground, subsoil waters and so on), waste water and drinking water. Information retrieval system allows to make search of all points of factual and bibliographic description.

Data base "Water. Analysis" includes the description of the methods of pollutants determination, their division, concentration, and also transportation of samples and their preparation for analysis. Data base has the information about the methods of biogenic elements determination and also inorganic (heavy and toxic metals, radionuclides, gases, ions), organic (pesticides, surfactants, halogenorganic and aromatic hydrocarbons, phenols, dibenzodioxines and soon) and biological water pollution analysis. Data base includes the information about the reagents and subsidiary substances, apparatures and devices used in the analyses. While describing the quantitative methods of analysis, metrological references, the information about the selectivity and the preventing factors of the substances determination are given.

Data base "Water. Analyses" went into being from 1987. Now it has more than 5000 notes from 1000 scientific articles, patents, normative documents, state standards specification and other publications and annually it is increased by about 1000 notes. The volume of the base on the magnetic carriers is about 2,5 Mbytes. Date base and program provision are given on the magnetic carriers for IBM-compatible personal computers. Data base materials are also spread as an publishing issue.

THE EXPERIENCE OF EVALUATION OF THE PARAMETERS OF NATURAL WATERS RADIATION-CHEMICAL CONTAMINATION IN THE CONDITIONS OF THE SOUTH-EAST OF WEST SIBERIA

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Water supplying is going to be the most significant problem of Mankind life-providing at the border of the XX-XXI centures. The grade of the natural waters contamporary pollution and its progressing character demand more and more attention and expences rather for protection and improvement of the already existing exploatation resources than for searching after new sources of drinking water. The timely detecting and the effective analysis of the negative ecological phenomena are more and more actual. Connected with it, the decision of the problems of hydrogeochemical mapping and ecological monitoring of both concrete drinkable units and the whole of fresh hydrosphere is obtaining the particular significans. Only on the basis of comprehensive information on the current state of the natural waters there is possible to take measures for water supplying quality protection, conservation, and improvement.

The evaluation of the radiation-chemical contamination of the natural waters is the particular, but the most keen contemporary ecological problem of the present. An experience of our investigations in this direction within conditions of Tomsk region permits us to express some considerations of cognitive, applied, and methodical character.

The revealed radiation-chemical contamination is poly-componented. Out of 200 water-soluble elements and compounds examined, the anomalies of tritium, nitrates, Cs-137, He, I, F, Li, Na, Sr, Cd, As, Th, Ce, Sm, Ba, tributilphosphates and its homologues, aromatic carbohydrates, paraffins, phthalates, and etc. are the most expressive ones. Natural waters microbiocenoeses are very specific too.

The epicentres of the majority of the anomalies dispose along the arc of an ellipsis at the lee side of a radiation-chemical plant at the distance of 15 km. The bulk of the contaminations is concentrated within a zone up to 25 km in diameter. Separate anomalous "spots" and "tails" are traced up to 50 km and futher. The main direction of the wind and a maximum remoteness of the contaminations are most distinctly traced by the fine aerial migrators(helium, tritium, fluorine, iodine, arsenic).

The radiation-chemical pollution takes place mainly on account of aerial industrial throwns-out and has a cumulative character. A complex analysis displays that the known accidental thrown-out at the

Siberian Chemical Enterprise on April, 6, 1993 not to have been the chief factor in the picture of the radiation-chemical contamination, but rather introduces it into as a particular case into a general rule.

An aerosol pollution is not as contrast as flows-out of the industrial refuses, but it is incommensurably broader and longer in its action. Owing to an active surface water exchange and because of specifity of geohydrodynamics, the aerosol fallings and infiltration of atmospheric precipitations are contaminating not only and not so much the surface waters but the underground ones. In some sites the underground waters use in water supplying is already inadmissible. At the same time, even within the most contaminated territories, the plots with high quality of the underground waters can be always find out. These plots, because of geofiltration peculiarities, are out of the pollution threat.The initial stage of the ecological-hydrogeochemical mapping of the radiation-chemical contamination is sufficiently effective while sampling according to a conventional net 5x5 km on the ellipsis area 2000-3000 km^2. This area must be oriented according to a wind rose and must contain he contaminating unit in its windward half.

THE METHODICAL ASPECTS CONCERNING IMPROVEMENT OF THE WATER QUALITY MONITORING IN THE SYSTEM OF THE ECOLOGICAL MONITORING IN UKRAINE

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In accordance with the Law of Ukraine "On Protection of the Environmental Nature" and with the Statute "On the State Monitoring" there was established "The Unified State System of Monitoring for Protection of the Environmental Nature of Ukraine (SEM of Ukraine)" where the observing services of the Ministry for the Ecological Safety, Ministry for Health Protection, Ministry for Forestry, Ministry for the Agricultural Production, State Office for the Water Economy, State Office for the Housing & Public Facilities, State Committee of Land, State Committee of Hydrometeorology, State Committee for Geology were included. Monitoring of the quality of the water resources shall be a purposeful information system and provide performance of the following main tasks in the system of the ecological monitoring of the country:

- observation and control of the level of contamination of the surface waters concerning the corresponding physical, chemical and hydrobiological indicators;
- study of the dynamics of the contaminating substances and identification of conditions when abrupt changes in the level of contamination occurs;
- study of the regularities in the self-purification processes;
- study of the consequences of taking the substances out through the estuary sites of rivers aiming at making balance of the chemical substances in the water objects.

To provide a unified approach to control of the quality of the water resources in the system of State Office for Water Economy there was developed a methodical base for the services of the hydrochemical, radiological and toxicological control prescribing the procedure of collection, processing and analysis of the received information. It is represented in three volumes of the guide-books on control the quality of the water resources and on the methods for studying the water quality; these materials were specially developed for the above mentioned purpose by the Ukrainian Research Institute of Water Distribution & Ecological Problems in 1995.

This report deals with the main issues of organization and implementation of monitoring, programme of observation, control of contamination, choice of the sites for observations, regularity of the probe making, methods of analysis and assessment of the data. It describes the methods for the complex assessment of the water quality and possibilities for its utilization in different branches of economy for economic and drinking purposes as well as for industrial needs, ameliorated agriculture and for fish industry.

The services of the hydrochemical, toxicological and radiological control in their activities shall be guided by the recommendations described in the corresponding guide-books; that will permit to improve the existing system of control of the quality of the water resources and implement in full scopes on the unified methodological basis programmes of the hydrochemical, radiological and toxicological controls through complex laboratories of the quality of water of the basin water distribution associations and regional water economic by performing assessment of the quality of waters in the water distri-

bution systems for the complex purposes as well as in those for the interindustrial and agricultural water supply, in the areas of the nuclear power stations influence.

The mentioned methods are described in the guide-books

- A Guide-Book on Methods for Controlling the Quality of the Water Resources in the System of the State Office for Water Economy (GOSVODKHOZ) of Ukraine;

- A Guide-Book on Methods for Controlling the Water Quality. Volume 1. Hydrochemistry. Radiology;

- A Guide-Book on Methods for Controlling the Water Quality. Volume 2. Toxicology

and may be used by all the Ukrainian organizations dealing with nature protection as well as by the interested CIC-countries performing designing, construction and operation of the complex-purposed water distribution systems.

SECTION V
ECONOMICS AND LAW

ECWATECH

NEW WATER HANDLING FACILITIES IN THE AZERBAIJAN REPUBLIC

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In connection of collapse of social system of water handling facilities in all post-soviet territory, including Azerbaijan Republic have been changed on all levels.

1. On intergovernmental level.

Most important water arteries in Azerbaijan are rivers Kura and Araz that are being polluted by different wastes on the territory of Georgia and Armenia. Nearby Russian borders of Samur river Samur-Absheron main channel has its beginning. This is main source of water supplying of Absheron Peninsula, Baku and Sumgait. Water intake of subsurface water (SW) works on the territory of Azerbaijan and it supplies settlements of Azerbaijan and Georgia by water. If previously, these republics had an agreement on water utilizing and were under the obligation to protect water sources from pollution, but now we have no such obligations.

Is required a summary of intergovernmental contracts on utilizing and protection of water sources to contiguous States.

2. On interregional level.

In existing social and industrial conditions it is unprofitable and difficult managing by the construction and exploitation of large water intakes, centralized group water intakes those supply by water some regions. Large water intakes, those are State's property destroy agricultural lands. Therefore, is preferred to construct small water intakes and local intakes of SW to meet requirements of concrete administrative unit or industry.

3. On interfarm and intrafarm level.

By creation of new form of land property-farms and private business, arise difficulties in exploitation and distribution of interfarm and intrafarm irrigation systems. Irrigation systems, those are property of the State, before interfarm distributors reserved in the State property and then turned over to the farm property, In each farm taken into account the requirements in water of all water consumers independently from the form of property.

4. On relations of the State and water consumers.

In the Azerbaijan Republic all water resources are national reaches and property of the State and turned over to the water consumers. Local water sources - water lines, small hydrotechnical constructions, water wells - turned over to the municipality property. Intrafarms irrigation systems, small reservoirs, single wells turned over to the property of private or co-operative farms.

Water consumption require payment.

Water consumers receive the rights for water consumption through government bodies. Government regulates and carries out control on water consumption.

NATIONAL POLLUTION ABATEMENT FACILITY AS A PILOT ON-LENDING MECHANISM FOR INVESTMENT FINANCING

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In the first half of 90s in Russia, like in other countries with transitional economy, there were unfavourable conditions for the environment pollution abatement activities financing, and especially for investment projects implementation.

The Government of the Russian Federation, having concluded the Agreement with the International Bank for Reconstruction and Development (the World Bank) for granting a loan to finance the Environmental Management Project, displayed its concern about the situation and made a real step in the direction of strengthening of the mechanism of investments in the environment pollution abatement activities.

Under the Resolution of the Government of the Russian Federation N 808 of August 11, 1995 "On measures to fulfill the Agreement between the Russian Federation and the International Bank for Reconstruction and Development on granting a loan to finance the Environmental Management Project", the National Pollution Abatement Facility (the NPAF) was established as a mechanism of funding enterprises and organizations of the Russian Federation on terms of on-lending to implement commercially viable pollution abatement projects.

It is necessary to note, that similar to the NPAF projects were earlier successfully implemented with the participation of the World Bank in China, India and other countries. In contrast to the mentioned projects, the NPAF has more tough economic restrictions, because the Loan Agreement stipulates that the investments reimbursement will be made by sub-borrowers for the account of additional profits, gained exactly through the investment project implementation and introduction of environmental friendly technological processes, which simultane-

ously enable to reduce hazardous environmental impact, material- and energy consumption, and to provide commercially profitable regeneration and utilization of pollutants.

The NPAF will provide sub-loans to enterprises for investment projects financing. The on-lending of the enterprises will be made in a hard currency (US dollars) at approximately 10.5-11.5% annual interest rate for up to 8 years and will provide grace periods of up to 3 years. Loans are to be within $350,000 - $7,000,000 range, covering up to 70% of the total project cost.

The NPAF has the following financial resources for preparation and implementation of investment projects:

- 50 mln. US dollars - Part B(2) of the World Bank's Loan for granting as sub-loans;
- 5 mln. US dollars - Part B(2) of the World Bank's Loan, designed for investment project preparation advances;
- 3 mln. US dollars - funds of the Grant of the Government of the Swiss Confederation, designed for implementation of 30-32 pre-investment studies and environmental audit of several industrial enterprises;
- 3.8 mln. US dollars - Part B(1) of the World Bank's Loan for covering the NPAF establishment and promotion expenses;
- besides, preparation of the Draft Agreement with the Government of the Swiss Confederation on granting a loan at amount of 12 mln. Swiss Francs, designed for co-financing of investment projects.

To increase investment resources and amount of projects, the NPAF will make efforts to involve domestic, as well as foreign commercial banks, investment companies and funds into participation in the NPAF. The NPAF will actively use various schemes of project co-financing. It is supposed, that Russian enterprises, banks and other investors will invest no less than 75 mln. US dollars.

General management of the NPAF is executed by the NPAF Supervisory Board. Its status and membership were adopted by mutual decision of the Ministry of Environment Protection and Natural Resources of the Russian Federation, the Ministry of Finance of the Russian Federation, the Ministry of Economy of the Russian Federation. Operative management is carried out by the NPAF Directorate. It is designed to identify, assess, prepare and supervise investment projects.

Enterprises, as well as industrial and regional executive authorities are very interested in the participation in the NPAF. For several months of the NPAF operation there have been registered more than 320 sub-loan applications.

As a result of evaluation and analysis of the received applications, the NPAF Directorate selected 130 of them, which reply the NPAF basic criteria.

The requested investments under the project applications, included into the NPAF Master List, are more than 450 mln. US dollars.

As a problem that restrains the NPAF effective implementation, we can note a relatively poor preparedness of the presented investment projects (that have investment feasibility studies or business-plans meeting international standards). In that connection, it takes much time for preparation and assessment of project documentation.

By the present, pre-investment studies implemented by international consultants at the expense of the Grant of the Government of the Swiss Confederation have been organized. These studies will enable to prepare in June-August 1996 several agreements on granting sub-loan and advances for preparation of project documentation.

The above stated facts show us that total request under the applications is 6-7 times more than the NPAF available financial resources, while the flow of new proposals does not run low. Weekly the NPAF Directorate receives up to 5 new applications.

The NPAF Supervisory Board has make a decision - at the same time with preparation of several projects for granting sub-loan to continue the forming of expanded investment project portfolio (45-50 project), which can form the basis for rapid preparation of a second environmental loan of the World Bank, and also can be offer to various Russian investors.

COMPARISON OF WATER SUPPLY AND WASTE WATER DISPOSAL UNDER THE CONDITIONS OF THE PLANNED AND MARKET ECONOMY

Dipl.-Kfm. Karl-Friedrich Bartz
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BASIC PROVISIONS.

The general economic and legal status have radically changed for water supply and waste water disposal enterprises during a transition period from the centralized planned economy to the market economy.

Transition is under way from the centralized state planned and price targets to the planning at separate enterprises and individual establishing of prices on the basis of the actual costs.

An individual production system of financing and accounting is a decisive instrument in the management of an enterprise. It is necessary to organize and to develop an internal and external accounting system in accordance with information requirements and legal standards.

Staff skill should be improved to meet new tasks and requirements.

PRICES AND PRICING POLICY OF PUBLIC ENTERPRISES ORIENTED TO COSTS (GENERAL ECONOMIC AND PRODUCTIVE-ECONOMIC ASPECTS).

Price formation at public water supply and sewage disposal enterprises should be carried out in the same conditions as at private enterprises. Prices are a decisive reference point of demand and supply in the market economy.

Deficit incurred when prices do not cover costs results in incorrect general economic distribution of the limited finds. At a public enterprise a price should also cover the costs incurred in the process of production.

Price for water and waste water is not formed as a result of competition. A method of costs covering is used in economy and organization of production. Costs include production costs and capital investments. The method of equivalence is used in relation to separate groups of consumers, such as housekeeping and industry, i.e. the customer must pay the amount which the enterprise spends on its output. The actual relation between costs and output can be a criterion of calculation.

The price structure includes the price system and the deposit system. In case of the price system, the customer pays the costs which correspond to his actual consumption. In case of the deposit system, the customer pays the costs connected with the services offered to him.

PRICES AND PRICING POLICY OF PUBLIC ENTERPRISES ORIENTED TO COSTS (GENERAL ECONOMIC AND PRODUCTIVE-ECONOMIC ASPECTS)

Dipl.-Kfm. Karl-Friedrich Bartz
Berlin Association of Water Management Enterprises, Germany

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PROBLEMS OF FINANCING

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The investment requirement in water supply and waste water disposal is extremely high. It applies both to the East-European countries in which reforms are carried out, and the European Union states (Directive of the Council 91/217/EEC dated 21.05.1991 regarding treatment of public waste water).

To meet the investment requirements it is necessary to use, first of all, the possibilities of water management enterprises in self-financing.

These possibilities include:

- use of deprecation mechanism with reinvestments and refunding of the obtained loans;
- proportional participation of consumers in spending of investments by making deposits and subsidies for construction expenses;
- subsidies on the part of communes, districts and a state;
- use of profit accumulations.

A prerequisite for the above possibilities is a calculation of prices which is made on he basis of a visual preliminary estimate and should be drawn up finally in the interests of consumers.

If an enterprise reaches the indebtedness limit or its investment ability is restricted for some other reasons, it is necessary to check the realization of investments by binding of private investors. Water supply and waste water disposal enterprises or production and administrative buildings are the most suitable for this purpose. However, a private concessionare takes into account both the incurred operating

costs and capital investments which should ben an integral part of the price for water and waste water.

Private engagement in water supply and waste water disposal should be correspondingly encouraged by the state in the form of moderate taxes.

HIGHER EDUCATIONAL AND TRAINING IN ENVIRONMENTAL ENGINEERING

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The creation of the modern education and training system in the field of environmental engineering is a very important branch of the ecological reform in the new Russia. This system may provide the traditional higher education in environmental engineering and the continuing education and training for professional development of the several level managers and engineers: federal and local authorities, industry, universities, trading and so forth.

Education and training in the field of the surface and groundwater management is the part of the total environmental education program.

The objectives of the new institution creation in the Moscow State University of Technology, namely these are: Center "Ecology & Safety", Department of Environmental Engineering and Nongovernmental Ecological Institute are the design and application of the main directions of the new education system.

Following approaches are applied in our activities and the correlating models of education are designed:

- Full-time multi-disciplinary courses of the graduate higher education (4 years) in environmental engineering and safety, certificated by the Baccalaureate Degree Diploma in Environmental Protection;
- Postgraduate education (2 years) in environmental engineering and safety, certificated by the Master Science Diploma in Environmental Engineering and Safety;
- Special course "Environmental Engineering" (1 semester) for students of the Moscow State University of Technology to give them the basic knowledge in environmental sciences;
- Module learning system in environmental engineering for training and professional development;
- Multi-media system to support the different models of education in Environmental Engineering.

All education models and tools are applied in the Moscow State University of Technology and in the Ecological Institute.

The open education system of the Ecological Institute gives the opportunity to the test the new courses and teaching methodologies. We collaborate with the International Center for Module Education System Training of the International Labor Office in application of the environmental sciences module learning system.

NPAF: EXPERIENCE OF ASSESSING AND SELECTING INVESTMENT PROJECTS

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1. National Pollution Abatement Facility is a mechanism of identification, assessment, selection, financing and accompanying of investment projects designed to reduce levels of environmental pollution and rationalize use of natural resources on the territory of the Russian Federation.

2. Financing of environmental projects in the frame of the NPAF is carried out first off all at the expense of the IBRD loan given in 1995 to the Russian Federation. The NPAF was designed as a mechanism of channeling and effective use for environmental goals of financial resources of all potential international and official (governmental) foreign creditors, investors, donors. At present, for example, a draft agreement on granting financial assistance worth 10 mln. US dollars by the Swiss Government to Russia for environmental projects which would be selected and financed in the frame of the NPAF has been prepared. The Swiss Government also has given a grant for pre-investment studies which would help to identify the most promising projects in the frame of the NPAF.

3. One of the major goals of the NPAF is to arrange co-financing of concrete investment projects by attracting resources of commercial banks,

other credit institutions, investment funds - both Russian and foreign.

4. The NPAF is designed to be a powerful center of attracting financial resources - both domestic and foreign, public (state) and private for implementation of investment environmental projects in Russia. For that aim it is necessary to work out very definite and clear procedure of identification, assessment and selection of the most commercially effective and environmentally most beneficial projects.

5. The NPAF Directorate - a structure of operative management of the Facility - for the first year of its existence has accumulated a certain experience in this field. To a certain degree, this experience has been used for developing "The NPAF Operative Instructions Manual" - a document approved by the NPAF Supervisory Board in June 1996.

6. The efficiency of the NPAF operative activities mainly depends on clear notion of "the team" what are the major phases and stages of the project cycle and their content, on the right labor division inside "the team", professional level of each member of "the team" and its management.

7. The key "playing rules" in the frame of the NPAF have been defined by the Loan Agreement (Environmental Management Project) between the Russian Federation and the International Bank for Reconstruction and Development signed on February 6, 1995, where the key procedures of granting the NPAF sub-loans, investment project eligibility criteria, conditions and requirements for sub-borrowers (first of all, see Schedule 7 of the Loan Agreement). None the less, practical activities are more rich and diverse than any document. That is why in the process of the NPAF Directorate activities proposals and recommendations on making amendments and additions to "the NPAF Operating Instructions", and may be to the Sub-loan Agreement, may be worked out.

8. The key phases and stages of the NPAF project cycle are:

- receipt and registration of sub-loan applications;
- screening (express analysis) of an application;
- forming of the NPAF Master List;
- initial appraisal of an investment project;
- preparation of the conclusion on the investment project initial appraisal and its submission to the NPAF Supervisory Board;
- final appraisal of the investment project and preparation of the Appraisal Report with the key terms of sub-loan;
- approval of the project by the Supervisory Board, its including into the NPAF List;
- preparation of the Draft Sub-loan Agreement and all the other necessary legal documents;
- control over the project implementation until the Loan Agreement terminates;
- preparation of the Evaluation Report on project implementation results.

9. The given scheme of the project cycle in the frame of the NPAF is rather general and rough. Some details and procedures (for instance, coordination with the IBRD, the Ministry of the Finance of the Russian Federation and other institutions) have been omitted. In such cases, when an enterprise presents an application not only for project financing, but for project feasibility study preparation advance, the project cycle become more complicated and lengthy. The project cycle is subjected to definite corrections in such case when foreign donors (particularly, the Swiss Government) grant funds for pre-investment studies implementation. Probably, the project cycle scheme, proposed in Paragraph 8, looks too complex and requests too much time (and also financial and human resources). However, the duration of pre-investment stage of the project cycle can be reduced. Firstly, by means of a clear labor organization and a high competence of the NPAF Directorates specialists and consultants. Secondly, by means of a high degree of preparedness of the project documentation at the moment of application presenting, and also owing to ability of an applicant to react upon all the NPAF Directorates comments and recommendations operatively and competently.

10. The NPAF in its operative activities follows both "quality" and "quantity" goals. Following "quality" goals means, that the NPAF list (portfolio) is to be replenished only with investment projects providing high economic (commercial) efficiency and maximum environmental improvements on the local/regional levels and having minimal risks. Following "quantity" goals means, that the NPAF Directorate prepares projects for future use, above its current financial possibilities. Firstly, we have some grounds to think that these possibilities will increase at the expense of new donors and additional resources. Secondly, we do not exclude the possibility of passing these projects on certain terms to other credit and investment institutions.

ENVIRONMENTAL AND ECONOMIC PROBLEMS OF WATER USE IN UKRAINE

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Water provision of the Ukraine's economy to the significant degree is determined by territorial siting of water sources and by water resources distribution during a year.

Potential natural resources of river waters during an average on water supply year are 209.8 sq. km, from which just 25 per cent is formed within Ukraine. During a year the main part of the river flow

falls on the spring time: 60 to 70 per cent on the north and north-east, and 80 to 90 per cent on the south.

Annual water consumption of the economy is 29.5 sq. km, including 12.4 sq. km for industry (42%) and 3.8 sq. km for agriculture (13). General volume of water drain is more than 17 sq. km. The next branches of the economy are distinguished by significance of their water consumption and impact on the water resources: thermal power sector - 26 per cent of the general water consumption in Ukraine, agriculture - 38%, public utilities - 16%, metallurgy - 8%, chemical industry - 2%, machine building - 2%.

Reduction of industrial output and energy resources shortage caused to significant (21%) decrease of water volumes used in circulation systems of water supply. And under these conditions fresh water economy of productive processes at the expense of the water circulation was not decreased.

Conducted research prove that nevertheless the significant reduction of the water consumption, technological pressure on the water resources is still significant. The present-day irrevocable water consumption and contaminated water discharge are substantially higher than the environmental space of water systems. In this connection even during an average on water supply year for the main part of Ukraine's territory the volume of irrevocable losses and the volume of contaminated water discharge exceed every norm, and for seven oblasts (regions) water consumption is 2 to 16 times higher than their own water resources.

So practically a half of the Ukraine's territory is under the technical pressure and is characterized as a territory with tense water balance and hydrological situation. Especially complicated environmental situation arised in the Dnipro River basin where the mostly water capacious industrial and agricultural enterprises are concentrated. And radioecological problems should be added, because there is no world experience of the similar concentration of nuclear power plants. Catastrophe at the Chernobyl NPP showed the whole range of social, environmental and economic problems which do mot till present have neither theoretical, nor practical solution. In particular, they are problems of water provision for the population and objects of the economy. For the last years conditions of the river basins of Danube, Dnitsro, South Buh, and also the Azov Sea and the Crimea river basins became substantially worse.

Underground waters are under the pressure of pollution. As a rule their contamination is connected with flow of different kinds of discharge water into the underground horizons and with intensive exploitation of the productive underground water horizons. Contaminated water sites are principally situated within the places of location of big industrial and agricultural objects. The areas of contamination of the underground water are in Dnipropetrovsk, Zaporizhzha, Mykolayiv, Odesa, Kherson and other oblasts, and in the Crimea. The natural waters of Polissya Region are exposed to substantial metamorphism.

Following to the above- mentioned it is needed to emphasize that increasing technological pressure on water resources demands for solution at a principally new level of the integrated problems of rational use, protection and reproduction of the water resources potential, conservation of ecological balance of the natural water reservoirs, taking into account the following development of productive forces of Ukraine.

ENVIRONMENT MANAGEMENT PROJECT IS THE LARGEST ENVIRONMENTAL PROJECT IN RUSSIA FINANCED FROM THE MEANS OF THE WORLD BANK LOAN

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The International Bank of Reconstruction and Development (IBRD) or the World Bank, as it is also called, is the organization which belongs to the UN system and is managed by the Council of Directors. Since 1992 the Russian Federation has been represented it the Council of Directors.

In course of its development IBRD used to outline for itself (or was outlined) various strategic tasks and used to implement these tasks through mobilization of funds and granting these funds to the states - recipients on favorable financial terms as a rule. On the other hand allocation of the funds by the World Bank is accompanied by thorough development of the financed projects, control over their implementation and subsequent adoption of the project implementation results in practice (in case the project is not related only to provision of equipment or construction).

During its half-a-century history the Bank has developed well-defined procedures of goods and services procurement under the projects. These procedures are based on the principle of tenders and envisage both equal access to participation in international tenders for organizations and firms of the countries - members of the Bank, and some privileges in these tenders for the agencies of the countries-recipients.

Of course, any country has its own strategic interests. And it is the country itself which is to decide whether to attract the World Bank loans for the development of its strategic branches and therefore to make a choose: either stagnation of the branch due to the lack of internal resources or the risk to admit

delivery of foreign goods and services and thus become dependent on their properties.

Positive features of the cooperation with the World Bank are as follows:

- the projects developed with its participation are considered to be reliabile and promising both for individual states which may add their funds on the bilateral basis and for private capital.
- the Bank may give the credit (including free) for development of the projects either through confiding funds of some countries in the Bank or specialized national and international funds.
- development and implementation of each project is accompanied by establishment of the national infrastructure for projects management which becomes the basis for the internal market of consulting services facilitating in their turn improvement of investment mechanisms to make them consistent with the international experience.

Thus, if I am asked whether it is useful and beneficial for the country as a whole and its individual organizations to cooperate with the World Bank, I answer without slightest doubts: it is extremely useful and beneficial, and much more beneficial than it may seem in the first stages of cooperation with this Bank.

Overcoming of interstate barriers which resist the inflow of the goods and services from one countries to others is emphasised by the World Bank as the tool of economic stabilization and international development.

However, procedures of the Bank are so "sophisticated" and the openness of operations under the projects is so considerable, that the rough intrusion of the foreign capital to the internal market is in fact impossible.

Moreover, these procedures frequently facilitate implementation of the projects through joint ventures and national enterprises and organizations, whose goods and the services are known for relatively low prices and high quality. Having acquired experience in course of the development and implementation of the Bank's projects these enterprises and organizations become the qualified participants of the international market of goods and services and may serve as an example for other national companies and organizations.

As for the "International Tender" as the Bank's procedure element there are in fact critical considerations in relation to this element. On the one hand, tenders allow to reduce the purchase price (by 40 %, they say) , on the other hand tenders consist of so many stages, that they may last not less than a year. Besides everything should be arranged in such a way that none of the potential suppliers in the countries-members of the Bank is offended. From time to time the results of tenders give rise to legal proceedings and interbank claims. Therefore it is actually impossible to make prompt procurements through such tenders. Nevertheless, the World Bank is a flexible system: the Bank establishes its own rules, and it is the Bank itself that may change these rules. The principal thing herewith is to provide convincing reasons. In this respect the World Bank procedures are more flexible, than our national legislation with its numerous contradictory provisions.

The Environment Management Project, financed from the means of the loan provided to the Russian Federation by the World Bank (the Project) was launched in 1992 as the part of the Environment Framework Program of the Russian Federation. The EFP is a set of projects, financed from non-budget sources (primarily foreign for the day present). Its basic idea is to acquire foreign experience to settle management and infrastructure problems and to finance certain economic objects in order to eliminate environmental problems.

At present alongside with this project (amount of US $ 110 million) the WB portfolio of projects includes two projects of the Global Environmental Facility:

*gradual elimination of ozone-depleting substances (the Grant equivalent to 60 mln. US$)
*biodiversity conservation (Grant equivalent to 20 mln. US$)

*the grant of the Government of the Swiss Confederation for pre-investment studies in the amount of 3 mln. of US$.

These means are managed by the Russian party in accordance with the rules and procedures of sponsoring organizations and in compliance with the appropriate loan and grant agreements. Originally the Environment Management Project was envisaged as a complex of technical assistance components:

- Institutional and Policy Strengthening
- Environmental Epidemiology
- Water Quality and Water Resources Management
- Hazardous Wastes Management

In course of its development the Project has underwent a number of changes which resulted in establishment (within its structure) of the National Pollution Abatement Facility program (NPAF) which facilitates self-financing for this project. All technical assistance components of this Project which are implemented in three regions - Upper Volga (Yaroslavl, Vologda, Ivanovskaya, Kostromskaya and Tverskaya oblasts); the Urals (primarily Sverdlovskaya oblast) and the Lower Don region (primarily Rostov oblast) are to:

- adjust existing or develop additional economic instruments for regulation of environmental activities,
- develop regional plans of environmental activities with subsiquent implementation of the key elements with assistance of the most qualified foreign specialists employed by the Russian Party in accordance with the Terms of Reference developed by it;
- assess the state of some branches of industry and to identify on this basis management mechanisms to reduce their detrimental impact to the environment;
- apply the obtained results in development of investment proposals.

Besides it is envisaged to modernize water quality and water management system, to introduce new approaches insuring rehabilitation of many water bodies and to facilitate the inflow of funds to the

following trends: water treatment stations, drinking water supply systems, sewerage systems etc. The need for the rehabilitation, modernization and expansion of the existing infrastructure of water management is evident. However, as the foreign experience shows, it is likely to be more cost-effective to concentrate initially on strengthening existing management, introducing new technologies and approaches, including economic incentives and identify priority projects and programs than to commit large, scarce resources to uncertain improvements and costly infrastructure. It is with this purpose that the Component "Water Quality and Water Resources Management"is developed.

At present there is no integrated Hazardous Wastes Management system in Russia. The task is to develop both theoretical basis and regulatory and information management mechanisms facilitating reusing part of wastes as secondary resources. The system of assessment of the environmental quality impact to human health is to support decision-making on urgent and strategic measures on rehabilitation of the environment.

Each technical assistance component of the Project is managed by the corresponding federal and regional Component or Subcomponent Management Committee comprising authorized representatives of all concerned bodies of executive power, academic and research institutes. The abovementioned authorities have signed so called Framework Agreements. These Agreements outline the principal activities to facilitate implementation of the Project and their responsibilities for application of the Project implementation results in the practice of the State policy formulation. The Committees exercise strategic management of the Components Implementation Teams established under the Centre of Preparation of International Projects on Technical Assistance (CPPI). CPPI is the agency established by the Ministry of Environmental Protection of the Russian Federation which is assigned responsibility for the Environmental Framework Program management.

Committees in their turn are subordinated to the Project Supervision Board established by the Governmental Environmental Commission in accordance with the Resolution of the Government of the Russian Federation. Supervision Board comprises high officials from at least dozen Ministries and agencies of the Russian Federation. It holds meetings not less than four times a year to adopt principal decisions on the Project including those related to application of the Project results.

The National Pollution Abatement Facility program is the most promising part of the Project regarding its prospects of long term development. Russian enterprises are so interested in the participation in NPAF that within several months of this program operation they have submitted more than 300 sub-loan applications for the total amount of required credits exceeding 1,5 mln. US$. It is necessary to note that the credit amount for each project from the means of the NPAF loan varies from 350000 to 7000000 US$; financial guarantees are provided as well as financing from other sources which makes about than 30% of the total amount of each project.

20 projects financed from the means of the Loan of the World Bank are being implemented in the Russian Federation. The total amount allocated for these projects exceeds 4 bln. US$. Environmental Management Project is one of these twenty. It is of medium amount but the most promoted and diversified with respect to its structure. Its peculiarity related to integration of regional and federal Technical Assistance Components with the Investment Program makes it unique among all the Projects of the Bank. It is the largest environmental project of the World Bank. Due to its framework properties (that is prospects of further extension) it has become the core of the Environmental Framework Program of the Russian Federation. Most of these projects are managed and coordinated by the CPPI and its regional effiliates on behalf of the Ministry of the Environmental Protection and the Component Implementation Supervision Board.

The Centre for Preparation and Implementation of International Projects on Technical Assistance which was established under the Ministry of Environmental Protection turned out to be one of the most advanced Russian agencies (with respect to its structure) dealing with the efficient and flexible management of the World Bank projects. The system of cooperation of regional and federal Component Management Committees, Supervision Board, NPAF, and CPPI as well as Components Implementation Teams, regional affiliates, developed under the Project, is unique in the international practice.

REGIONAL ASPECTS OF SYSTEMATISATION OF PROJECTS OF PROCLAMATION OF THE WATER RESOURCES

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A brief analisys of the regional objectives on provision of ecological stability is presented. A classification of investment sources and basic requirements to the economics of the prejects on sanation of the water resources of the region is considered. A summary overview of prospective projects of different scale is presented, including: modernisation of major city water pumping stations and improvment of drainage strusture, the program on ecologisation of living estates in the water protection areas, economical and technological solutions on re-proceeding of water industrial wastes,

utilisation of old ships, botting of pure water etc. Statistical data on funding the ecological objectives of the water sector are provided.

DETERMINATION OF WATER COST IN IRRIGATED AGRICULTURE TAKING INTO ACCOUNT ECOLOGICAL FACTORS

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In the period of market formation in Russia there is necessity in further deeping and development of economic relations between links of agro-industrial complex. It concerns irrigated agriculture to a great extent.

Lack of economic relations in the lower link between agricultural and water resources firms does not assist to perfect watering technology and rise efficiency of using water and land resources and economic efficiency of irrigation.

In conditions of water resources pollution the question of taking into account ecological factors in determination of water cost in irrigated agriculture is very important.

Determining water cost we suppose it would be expedient to reduce it (water cost) on the magnitude of value of detriment from culture watering by bad quality water. From our point of view value of detriment from bad quality water for irrigation purposes consist? of two main elements: reduction of crop due to watering by bad quality water in which saline content is more than maximum permissible matter concentration and additional expenses for keeping up soil fertility.

For arid zone the element of detriment is equalled supplementary expenses for flushing to avoid soil salinization; for steppe and dry-steppe zones for gypsuming and organic fertilizers which are necessary for self-supporting humus balance.

Reduction of crop from watering by bad quality water is defined on the base of experimental data. The doses of gypsum and organic fertilizers are defined accordingly prognosis of water-salt regime of irrigated lands.

This method makes it possible to define content of sorbed ions Na, Mg, Ca in adsorbing soil complex to the end of calculate period in dependence of infiltration loading or water-exchange between soil and subsoil waters.

Taking into account different variants of infiltration loading and using the method of calculation of water-salt regime, we can define bringing-in doses of gypsum and organic fertilizers according to the definite loading to the end of calculate period. And then it is possible to calculate additional expenses.

Necessary to say, that the magnitude of water-exchange between soil and subsoil waters dependens on melioration regime (irrigation norm of culture). That is why determination of water cost must be preceded by ecology-economic basing of irrigation norm of culture.

ORGANIZATION OF A WATER MANAGEMENT ENTERPRISE

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Water supply and waste water treatment are two tasks which have one common object, namely water, in the centre of their consideration. It is supplied as drinking water and is disposed as waste water.

This all-round task of water supply and waste water disposal is faced by an enterprise which is fully responsible for its execution. The enterprise should not be subordinated to administrative instructions. Interference of administrative bodies into the production management should be excluded to maintain an economically competent enterprise which carries out reliable water supply and waste water disposal.

Economic advantage depends mostly not on a type of proprietor (private or public property) and a type of right but on observance of market rules. The real power which possesses production factors should be in the hands of the enterprise management.

The sphere of the water management activity should be oriented to the requirements in water supply on the part of population, industry and public powers. Supervisory bodies should be represented, directly or through committees, by communes, land areas or districts.

The organizational structure of the enterprise will be characterized from the standpoint of superficial hierarchy and its correspondence to tasks, responsibility and powers in decision-making.

Lack of competition between monopoly water supply and waste water disposal enterprises should not be used to mask unprofitability. It leads gradually to increased prices and subsidies from a general budget which is not suitable for citizens.

The enterprise should offer its products on a free market to provide its profitability for a long time.

The future problems of water supply and waste water disposal should be solved by the enterprise employees who are progress-minded in business.

USE OF ECONOMIC INSTRUMENTS TO WATER QUALITY MANAGEMENT

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Improving environmental quality is complex multiaspect problem. In Russia the main approach to water quality protection can be described as "command and control". This approach begins with the identification of practical technologies for pollution abatement and requires polluters to adopt those technologies or achieve equivalent abatement, An alternative to "command and control" is incentive-based environmental protection, chiefly pollution taxes, but also including pollution abatement, With taxes on pollution, polluters have a financial interest to abate and be innovative.

These economic instruments (EI) can help to increase policies aimed at improving environmental quality. Many theoretical and applied research results have demonstrated that substantial cost savings are possible through their use.

Since Russia have limited financial resources, serious environmental problems, and institutions that are in the development, application of EI may be a fruitful. Both theoretical and empirical research has demonstrated that the use of transferable discharge permits or uniform emission charges is the least expensive means to meet a limit on total discharges. Economic instruments are an obvious extension of free-market reforms; as supplies and prices for marketable products are deregulated and opened up to market forces. It follows that supplies and prices for such "good" as BOD or nitrates should be allowed to float as well, rather than being controlled by a central authority.

Besides that in transition period it should be easier to implement fundamental reforms in environmental policy. Really these reforms will be seen as accompanying other radical institutional changes. The scheduling of goals and standards during the next 20 or 30 years are crucial. The starting point should be definition of overall quality goals for receiving waters set by central legislative bodies.

Implementation plans should be basin-wide, as basins are the natural unit of water management. The relative advantage of Russia is that the related management agencies have already established. There are both the Russian Federal Committee for Water Management and under the command of it regional scientific institutes and local water body authorities. Local authorities should begin implementing pollution control as early as possible and not wait external instruction and assistance.

Efforts should be made to develop step-wise planning and management procedures to identify goals, objectives, and alternatives, as is done in many Western countries. Basin-wide water quality planning and management is an established process used widely in the West and in Russia. Central, command-Type planning, as the only, -has been discredited and must be added with incentive-based approach, including economic instruments. Pure market approaches to water quality management are not possible. Water quality impact and economic implications should be evaluated jointly when formulating new environmental control legislation.

The polluter-pays principle is widely accepted as equitable. It should be followed where possible. The use of subsidies for pollution control should be critically re-evaluated and applied cautiously during specific transition periods. The report will be focused on above and others problems of water quality management in recent Russia.

INDUSTRIAL TREATMENT OF GROUNDWATER TO THE LEVEL OF DRINKING WATER

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In the territory of Berlin the storage of raw water treated to the level of drinking water includes natural ground water, bank seepage water and treated surface water with consequent infiltration to ground water. The ground water treatment plants were constructed in the seventies as a result of a decision of the water management bodies to counteract the drop of ground water level and to provide raw water storage.

The introduced charge for ground water intake in accordance with the Berlin Law of Water and the reduction of water consumption after the German state was reunified led to a careful analysis of operational costs for production of raw water. Irrespective of the technical, hydrological and ecological standards which should be observed, an optimal method of functioning of water management enterprises was worked out to reduce operational costs.

The charge for ground water intake increased from DM 0.30 to DM 0.60 per cu.m in 1996. The quantity of water coming from the Berliner Wasserbetriebe to ground could be attributed to the general intake, i.e. each cubic metre of artificially enriched ground water reduced the charge for ground water intake. Thanks to a high load of the capacities of some water management enterprises and a resulted hydraulic slope, the ground water treatment plants could operate under a high load, which in all led to a decrease in the charge for ground water intake. Such more optimal treatment of ground water resulted in saving of costs in the amount of DM 8,000,000 in 1995 which will make up approximately DM 15,000,000 in 1996.

PUBLIC ENTERPRISE IN THE CONDITIONS OF THE MARKET ECONOMY AND WITHOUT PRIVATIZATION

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The purpose-oriented programmes of drinking water supply, such as "Restoration of the Volga river" and other projects of water economy development adopted by the Russian Federation Parliament and Government, call for the intensification and improvement of cooperation between official persons on the federal, regional, municipal and production levels.

The set tasks are s guide to action for responsible leaders and specialists, i.e. it is necessary to make ecologically and technically optimal decisions on the provision of high economic efficiency of both investments and processes of water supply and waste water disposal.

It calls, first of all, for the perfection of operating production and economy structures on the regional and municipal levels, which operate on the market economy principles, manage consistently expenses and solve the problems of water supply with high economic efficiency.

Development of efficient technical and economic management calls for a new definition of rights and obligations of municipal managerial structures and a clear definition of the status of water management production units as enterprises.

A new definition of functions, rights and obligations of managerial structures is needed in relation to water management enterprises. Taking into account the operating activity of enterprises, they must be relieved of a direct responsibility and dependence on regional and municipal managerial structures. It is necessary to establish independent production structures with competent management of expenses and to introduce the tariff systems which, after they are approved by regional or, correspondently, municipal parliaments and departments, will cover at least the expenses on water management processes.

The full production independence could be the next step, i.e. confirmation of production costs as an important justification of the tariff system perfection, and taking into account of expenses on the reconstruction and expansion of the production capacities from the standpoint of prices and tariffs.

In evaluating the productive-economic, managerial and production structures, and establishing the systems of supply and organization of production processes in the water management as a whole, one should take into account expenses on this development and weigh justification of these expenses with regard for the minimum ecological requirements.

First of all, it is necessary to provide for innovation intensity which speeds up economic formation of the ecologically required processes of the development within the supply system. The ecological situation calls for improvement of ecological awareness of all those who take part in productive-economic and productive-technical processes of the development. When ecological standards change, a real situation on a national scale and the limited economic resources should be taken into account. It is necessary to adopt compromise settlements which include economically and ecologically acceptable steps to be taken for achieving the ultimate aims.

Clear and compulsory directives for the formation of prices and tariffs, and gradual economic independence of enterprises are a prerequisite for concentration of the ever reduced central state funds for infrastructure measures and projects aimed at provision of water management of national and international significance.

The economic potentials available in the limited volume on the national, regional and municipal levels do not provide any longer granting of big subsidies to water management enterprises and call for the reformation of the relations between water management enterprises and their clients, which become worse during a long period of time, to normal production relations.

Formation of prices and tariffs, efficient management of expenses, clear economic, technical and ecological processes at water management enterprises are a prerequisite for high efficiency of utilization of the funds available for water management measures in a very limited amount on the national, regional and municipal levels.

The restricted natural and economic resources call for care of them in order to achieve gradually at least the average European level in the consumption of these important resources. Simultaneously, it has enormous influence on the formation of capacities in water management, the determination of investments,

and, thus, it provides possibility of competent water supply of the major part of population by using the limited funds and solution of urgent problems of waste water disposal in the regions of Russia.

ON THE PROBLEM OF THE INTRODUCTION OF WATER CODE OF THE RUSSIAN FEDERATION INTO ADMINISTRATIVE PRACTICES OF SUBJECTS OF THE RUSSIAN FEDERATION AFTER THE EXAMPLE OF THE LAW OF WATER OF THE FEDERATIVE REPUBLIC OF GERMANY

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The report induces to the publication of legal and administrative documents in the Russian Federation aimed at the introduction of the draft Water Code of the Russian Federation, coming from the water legislation of the Federative Republic of Germany which, apart from federal, or formal, laws acting in the whole territory of the Federative Republic, for example, the Law of Water Management and the Law of Waste Water Taxes, includes a number of legal acts, or laws issued by federal bodies, and intra-administrative laws, or so-called administrative regulations and guidelines by which federal laws are realized or, correspondingly, put into practice.

1. Para. 7a), item 1 of the Law of Water Management includes the minimum requirements for waste water discharge to water reservoirs, which are valid for the whole Federative Republic. The requirements are defined concretely in the so-called general administrative regulations of the Federal Government. They specify emission values of concentrations for different types of water discharge, water sample types and methods of analysis. It corresponds to Article 11 of the Russian Law of Water.

2. Para. 7a), item 3 of the Law of Water Management includes the so-called rates of indirect water discharge for federal lands. They define the extreme values of harmful impurities (heavy metals, etc.) in accordance with the conditions of equipment designed for waste water discharge to public sewage disposal system. A model project was worked out for this purpose by the so-called Water Community of Land Workers and by the Federal Institute. The corresponding provisions take place in Articles 42 and 45 of the Russian Law of Water.

3. Para. 18c of the Law of Water Management states that a permission is required for the construction, operation and radical changes in waste water treatment works. This permission is issued only for such process which corresponds to the requirements of the Law of the Environmental Protection. Thus, the requirements of the Law of Water Management are made more precise by another federal law because they deal with the environmental protection. The corresponding provisions can be found in Article 46 of the Russian Law of Water.

4. In conformity with para. 36 of the Law of Water Management, the so-called general plans should be worked out for river basins or industrial zones to create the necessary water management prerequisites for the development of living conditions and economic relations. The Federal Government issued the guidelines for elaboration of the general plans in the form of the so-called general administrative rates to bring the plans in correspondence with the same principles as far as possible. They specify in a general way the significance, purpose, content and principles of the general planning and the specific requirements to the plans worked out in lands. The Technical Rules serve this purpose and include specific technical instructions on hydrogeology, tectonics, etc.

5. In compliance with para. 36b) of the Law of Water Management, lands should work out the so-called plans of water management which deal with water reservoirs protection, care of water reserves, and requirements for their use. Para. 36 authorizes the Federal Government to issue general administrative standards for setting up of water conditions parameters and to specify the parameters to be shown in of water management plans. To this end, on September 19,1996 the Federal Government issued a general administrative rule about the minimum content of water management plans.

6. In conclusion, as regards water planning Para. 18a) of the Law of Water Management recommends to lands to work out plans of waste water disposal in accordance with territorial principle. In the first place, a site for important water treatment works, a service area, the main specifications of water treatment, etc. should be determined. Elaboration of such plans is a responsibility of lands and is imposed on them by federal law. The corresponding provisions of water planning can be found in Articles 7, 13, 14 and 15 of the Russian Water Code.

ORGANIZATION, PRICING POLICY AND FINANCING OF PUBLIC SUPPLYING ENTERPRISE

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Organization of economically profitable business oriented to public welfare is a prerequisite for long-time successful functioning of a supplying enterprise.

Enterprise leaders should be fully empowered to make decisions with respect to labour force and materials. Public and political institutions should not have a direct influence on the methods of enterprise functioning.

The enterprise tariff system should be clear for clients and simple in realization. Customer should be aware of the fact that the price corresponds to the accomplished job.

Enterprise leaders should exercise all available possibilities, such as self-financing, increase in capital through proprietors, loans, leasing or other similar types of financing which correspond to economic criteria. They should be free in the choice of the most profitable combination of financing.

Only profitably organized enterprises, pursuing a policy oriented to long-time success and using the most profitable means of financing for achieving production targets, will achieve optimal results for proprietors and provide cheap and reliable supply to consumers for a long time.

METHODIC BASICS FOR TAKING INTO CONSIDERATION THE WATER ECONOMIC AND ECOLOGICAL PECULIARITIES OF THE WATER OBJECTS WHEN ESTABLISHING RATES FOR PAYMENT FOR UTILIZATION OF THE WATER RESOURCES

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The existing up to now basin standardized rates for payment for water do not completely perform the role of an economic stimulus for the rational utilization, protection and restoration of the water resources.

This is accounted for by a number of reasons: an imperfect degree of the territorial differentiation of payments within the borders of the basin of a river, not taking into consideration of influence of the large water economic objects on the conditions of the water supply to the districts that are lower of the place of situation of those, orientation on the averaged for the basin deficit of the water resources.

With transfer on the market conditions of the economy management, with changing the tasks as functions of the productive organizations there is suggested to eliminate the above mentioned disadvantages by improvement the methods of formation of the rates to be paid for water. The suggested territorial differentiation of the payment rates for utilization of the water objects shall be realized by implementation for the water distribution economic-ecological facilities of subdivision into districts of the basins of the Ukrainian rivers, that is to be done on the basis of the following criteria:

- different influence of separate water distribution actions on the water supply conditions;
- different qualitative state of the water resources within the borders of one basin;
- different states concerning the water deficit in separate areas of the same basin.

To implement the territorial differentiation of the rates in payment for utilization of the water resources there was developed a diagram.

All the procedure of differentiation will consist of:

- collection and analysis of the hydrological, water distribution, economic and ecological information;
- determination of the limiting sections, districts of validation and calculations of the differentiated payment rates relating to the situation concerning the water supply;
- characterization of the ecological state of the water resources;
- identification of the deficit districts of validation of the unified value for the rate depending on the quantitative and qualitative indicators of the water resources;
- mutual adjustments between the districts where concrete payment rates for water are valid but with that there is taken into consideration the deficit and qualitative state of the water resources;
- determination of the value of the defferentiated rates concerning payments for water.

Implementation of the suggested approach on example of the main basins of the rivers of Ukraine has shown that the studies territory is divided: concerning the conditions with the water provision and implementation of the water distribution actions - into 10 districts; concerning the ecological state of

the water resources - into 45 districts; concerning the deficit of the water resources - into 19 districts. The mutual adjustments of the districts borders relating to each of the mentioned criterion permitted to identify the borders of 45 districts where there are valid the unified rates for payment for utilization of the water resources, the variations in the values of the rates (in the prices on 1.02.95, krb/m^3) depending on the basin are: Dnieper - 37.5 to 576.0, Dniester - 28.5 to 69.0, South Boog - 51.0 to 75.0, Seversky Donets - 45.0 to 141.0. The highest water cost is fixed in relation with the the rivers of the Crimea, the lowest one - in the basin of the Western Boog.

OPTIMIZATION OF THE ECOLOGICAL-INVESTING POLICY BY REALIZATION OF WATER PROTECTION ACTIONS IN THE SMALL RIVER BASINS

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There have been worked out criteria for optimization of the ecological investing policy which are based on meeting the ecological and socio-economic requirements having taken into account the capital investments on carrying out of the water protection actions and the expenditures on operation of the water protection objects.

As the basic ecologic criteria there were chosen the socio-ecological functions of the system model for classification and calculation of the antropogenic loading on the river basins developed and widely tried by the authors on the objects of the distributing facilities.

Optimization of the ecological-investing policy is reached when utilizing the two-criterion model of the ecological-economic effectiveness of investing.

Task setting. When comparing different variants of implementation of a project in the basin of a small river one should choose a sequence of variants of the ecological-investing policy that is the optimal one in the given set. Each project in which investments of funds are made is implemented to satisfy certain economic and socio-ecological needs, and it requires different expenditures for its realization. That is why into the base when developing the criteria for optimization of the ecologic-investing policy there should be put a compromise between meeting the ecological and socio-economic requirements and the corresponding capital expenditures on their implementation as well as the expenditures on operation of a water protected object.

Implementation of projects in the basin of a small river requires their comparison on the basis of their final ecological-economic effect which must be based on formalization of the ecological and economic criteria - functions of usefulness, development of corresponding mathematic optimization models and decision making systems.

In conditions of the limited capital investments funds the variants guaranteeing the maximal final ecological-economic effect should be implemented first of all.

There appears necessity to distribute the available capital investments in such a way, to find out such a sequence of the variants for improvement of the small rivers situation, as to make their utilization the optimal one.

For the base of the ecological criterion there were chosen the socio-ecological functions from the system model developed by us to classify the situation and to calculate the anthopogenic loading on the basins of the small rivers; in the model there were singled out the following subsystems: "The Radioactive Contamination", "Utilization of the Land Resources", " Utilization of the River Run-Off", "Water Quality".

One-Criterion Optimization Model. As the criterion of the variation of model effect we choose the increment of the ecological criterion on the set of alternatives of the subsystems (for example, "highly contaminated", "dirty", "contaminated", "satisfactory purety", "pure", "very pure") that characterize the river subsystems state. For this purpose on the set of the variants there is insert a sequence of the quantitive ecological estimations φ_1, φ_2, ... φ_4 and the corresponding imcrements of the given function

$$Dj_j (u)\ j = [1, \ldots N]:$$

$$Dj_j (u) = j_j (u_k) - j_j (u_n), \qquad (1)$$

where: $j_j (u_k)$ - the value of the ecological function in the final (improved state u_k;
$j_j (u_n)$ - the value of the ecological function in the initial state u_n (before implementation of the project).

Since the subsystems are characterized by different weight coefficients a_j, the value of the increment should be considered with a corresponding weight coefficient.

Analogically to the ecological functions, on the set of alternatives we shall consider a sequence of the values for the economic function - those of the reduced expenditures $f_j (u_n)$ and of the corresponding to it imcrements.

Let us now determine the ratio of the two functions, that is the specified ecological productivity or the ecological profitability of the reduced expenditures acoording to the variants:

$$\lambda_j(u_k,u_n) = \lambda_j\Delta_j\varphi_j(u)/\Delta_j f(u),\ j \in [1; N]\ (2)$$

The function $l_j(u_k, u_n)$ allows to compare effectively the variants showing the project which is the most perspective to invest the available resources in.

Now let us consider the task of determination of the optimal sequence of projects for improvement of the ecological state of the river on condition of the limited resources k as a task to optimize the function of the total effectiveness of the capital investments:

$$F(x) = \sum\lambda_j(u_k, u_n)x_j \rightarrow \max_{x \in k}, \qquad (3)$$

taking into consideration the limitations

$$\sum x_j < \text{ or equal to } k_j,$$

$x_j <$ or equal to k_j, $x_j >$ or equal to 0, $j \in [1; N]$, (4)

where: x_j - a change characterizing the unknown contributions into the j-th project; k_j - a maximum capital investments required for the full implementation of the j-th variant to improve the state of the river.

While solving task (3), (4) there is received a sequence of the projects P_1, P_2, ... P_e that is optimal implying investigation of their investing according to the ecological-economic criterion "the reduced expenditures vs. the ecological effectiveness".

Two-Criterion Model of the Ecological-Economic Effectiveness of Investment. We can get a more completed estimation of the economic effectiveness of the projects if , simultaneously with the function of the ecological profitability (4), we consider the function of the total economic profitability

$$G(x) = \sum\mu_j(u_k, u_n),\ j \in [1; N] \qquad (5)$$

where: $\mu_j(u_k, u_n)$ - the ratio of the increment of the economic effectiveness to the corresponding reduced expenditures.

The sequence of the projects which provide the optimal structure of the water protection actions in the river basins shall be found after solvation of the task of the two-criterion optimization:

$$(G(x), F(x)) \rightarrow \max_{x \in K} \qquad (6)$$

Conclusion. The concept of the water protected actions optimization in the river basins consists in the sequential optimization of the ecological-investing policy, which can be reached by using a formalized mathematical model "the reduced expenditures vs. the ecological effectiveness". The relation "expenditures vs. effectiveness" is estimated more precisely if to use the two-criterial model where the functions of the ecological and economic profitability are used.

SIMPOSIUM

WATER: EMERGENCY SITUATIONS AND ECOLOGYCAL SAFETY

ECWATECH

PRINCIPLES OF DEFINING PRIORITY WATER CONSERVATION MEASURES FOR ZONES WITH COMPLICATED ECOLOGICAL CONDITIONS

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Implementation of nature conservation programmes on the Federal level and of subjects of Federation is faced with a number of serious difficulties caused by shortage of funds and materials. It forces ecological and economic expertise to determine top priority measures within the framework of these programmes. Thereby, principles of defining top priority measures are not formalized, therefore decesions of the will may be made without reasonable grounds.

When defining priority water conservation measures a comprehensive analysis should be carried on the migration of pollutants through catchment area with surface runoff, groundwater flow in zones unaffected by local man-made activities, with groundwater runoff from urban areas, effluents disposed by municipal treatment facilities, by industrial and agricultural sectors, through intensive infiltration of high-strength and toxic wastewaters from sludge and tails storages, sewage holding ponds, filtration fields,sludge drying beds, toxic and solid household garbage disposal sites at preset parameters of trance-border pollutants transport in the atmosphere and hydrosphere.

In each specific case (region, water catchment area or other element of the environment) additive effect of the above mentioned factors forces to make decisions for further water conservation activities using generalized criteria which allow to estimate the contribution of each pollutant to the overall state of water resources. Later the solution of the problem will permit to realize the well known principle " polluter pays " more effectively.

As a generalized criteria it is proposed similarly to modulus of flow to use mass transfer modulus which represents quantity of contaminants being transpoted to water body per unit of time (in terms of mass) related to unit of catchment area.

When estimating contaminants coming from natural watershed,this value is determined at impurities concentration for a year or for any representative period,e.g. flooding.

When determining mass tranport modulus for urban areas the component of surface (storm ,melt) and underground runoff should be singled out.

The use of mass transport values permits to obtain comparable characteristics, to make up a balance of contaminants, to substantiate the need for localization of contaminants in zones of intense infiltration or toxic solid storage areas, the required degree of wastewater treatment, engineerng modification of water conservation measures (antifiltration curtains,screens,drains and others). The following regions seeking status of zones with unfavourable ecological conditions and drawing up programmes for getting out of this situation : towns of Kamensk-Uralsky, Orsk, Karabash and others, have been considered to demonstrate the application of the approach. It has been shown that in each specific case reduction in atmospheric emissions, localization of groundwater contamination in zone of wastewater, sludge and tails sto-rage areas, recultivation of process wastes or actually new aproaches to wastewater treatment may become of top priority.

NATURAL RISKS CONTROL IN WATER FACILITIES

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Risk control is a method of struggle with liability of engineering, economic and social objects as well as people and elements of environment to risks. Natural risks to which water facilities systems (WFS) are liable are primarily dangerous geological (seismographic, landslip) and climatic phenomena: low water level or high-floods, mud flows, banks transformation (erosion) and others.

The notion of risk is considered by many economists as a factor of production, the reduction or liquidation of which requires special capital means paid on one occasion only and annually. It is necessary to take into account this factor when calculating the dimensions of elements of water facilities systems and when estimating the probable cost of production, cost price, profit and losses.

The risk of development arises at investing capital, labour and resources in a new construction or expansion of the existing production because, for example, the actual volume of water supplied to the consumer or electricity generated appears less than it was planned. In contrast to the risk of development it is possible to distinguish the risk of maintenance including all kinds of risks arising at maintaining a certain level of production and distribution of

produce. To control risks in water facilities the following main systems of measures are taken:

- risk elimination connected with the change of a place, time or type of production, these measures because of their great cost or unfavourable social and ecological consequences find no wide application.

- risk prevention including increase of the capital character (class) of hydraulic engineering structures, irrigation or drainage systems etc.

- indemnification for the negative consequences of natural or ecological calamities, these measures involve insurances, assistance of state and local government bodies.

A particular list of alternative measures to control risks depends on the kind and specific character of risks as well as on the resources available to an enterprise, region or country.

In practice risks in water facilities should be regarded as inevitable, especially when the prospective cost of losses or damages appears less than the cost of measures aimed at elimination and prevention of or indemnification for these risks.

The efficiency of the made decisions is determined not only by high initial values of appropriate parameters, but also by the ability of WFS to maintain these parameters during the whole service life of the system, i.e. alongside with the already mentioned factors it is also necessary to take into account the influence of the time factor. Therefore it is necessary to use the theory of probability methods taking into account changes in serviceability of technical systems and their elements in the course of time.

The existing restrictions of economic, resourse and labour factors necessitate optimization of parameters of WFS reliability of work taking into account social and ecological consequences of the decisions made.

In conclusion it is important to point out that creation and maintenance of safely functioning water facilities systems is an urgent problem which involves ecological, technical, economic and social aspects.

EMERGENCY SITUATIONS IN WATER ECONOMY

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Futurologists assert that in future wars can break out for possession of fresh water sources. In the world more than one milliard people have no safe water sources.

As it is stated by A.L.Rogozin (1995) droughts present the greatest danger to people, they account for more than 50 % of those who died or suffered from natural catastrophes that happened in the world in 1962 ...1992s. The percentage of flood victims amounts to 36 %, cyclones, hurricanes, typhoons and storms cause 8 % of loses, earthquakes - 2 ...3 %. Annually the number of people who lose their lives in natural catastrophes increases by 4,3 %, the number of those who suffer - by 8,6 %, and economic losses increase by more than 10 %.

These negative tendencies are caused not only by population growth but also by the active development of new, less suitable for living territories; by the wide development of complex and dangerous technonatural processes (territory underfloodings, reservoir banks transformation); by the poor knowledge of regularities causing dangers and risks, as well as by mistakes in the policy of providing safety measures for population and nature.

The constant increase of such social losses results in spending more and more means in many countries of the world not on economic and social development but on rendering assistance to catastrophe survivors and on restoration of the destroyed.

Changing nature we always have both desirable and undesirable after-effects. Environmental crises testify to the fact that people make serious mistakes in the method and scale of use of their environment. These mistakes are rooted in insufficiency of the system of technical and economic criteria on the basis of which the decisions are made. Requirements of technical reliability are more or less observed whereas risk and danger for nature preservation are not always taken into account.

Danger is the process, property or condition of nature that threaten life or well-being of people and their environment. Risk is defined as a probable measure of danger for a district or region stated in terms of possible losses for a certain period of time (A.L.Ragozin, 1995).

To control ecological risks it is necessary to foresee what natural balance can be destroyed, what the probability and consequences of such destructions will be. Since it is difficult to evaluate in uniform cost parameters all kinds of risks, in practice separate evaluation of economic, social, technical and ecological risks with the subsequent analysis of the received results and making management decisions on the reduction of losses is applied.

Generally the ecological risk is defined as the main parameters of environment state evaluation: evaluation of influence on environment and evaluation of corresponding risks proceeding from the quantity and concentration of chemical substances

in run-offs and their accumulation in water-bodies, evaluation of people's state of health and the state of biota on biological integrated parameters.

On the basis of this information a complex evaluation of the current state of environment is carried out and the future development of the whole system is forecast. Checking the possibility of realization of the proposed water economy measures is carried out both on the basis of requirements of nature preservation legislation, and in accordance with legislative acts in which principles and norms of interaction of nature and society are stated.

FLOOD CONTROL CONCEPTION

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1. During millennium the humanity fights against floods but even in the epoch of scientifical and technological revolution it can not cope with them. Only for the latest hundred years the floods have taken away more than 9 million human lives. Annually the floods cause the damage in many billion dollars.
2. In Russia some 400000 sq. km (2 % of territories) are menaced by floods, in USA - 28000 sq. km (3 %), in Brazil - 300000 sq. km (3,5 %), in India - 250000 sq. km (7,5 %).
3. During this century the flood caused damage has increased by 10 times. There are some reasons for this. The principal on is the intensive economic development of the flood menaced territories, as the non-developed virgin territories decrease annually. The construction of different economic objects within the flood menaced territories results in the increasing damage caused by the floods of the same probability. The demolishing power of floods is not less important due to the increase of their recurrence and flood level owing to the intensive development of the watersheds and disturbance of the natural flow regulating conditions. That s why the floods have served their purpose in declaring the 90-s as a decade for control of natural disasters by the UN.
4. As an area of the flood menaced territories in Russia exceeds the Germany one it is undoubtedly necessary to elaborate and accept a flood control conception at a state level. Its essential points are the following:
- When using the flood menaced territories, a maximum economic effect has to be achieved in economic development of river valleys and sea coasts minimizing a flood-caused damage. In each case an optimal decision of this very complex problem should be found out.
- It is necessary to bring into concord the engineering and non-engineering measures of flood control basing natural and economic peculiarities of the flood-damaged territories.
- The complex of flood control measures must cover the whole watershed and not only its separate areas.
- The complex of flood control measures including their forecast, prevention, planning and realization must be carried out BEFORE, IN COURSE and AFTER a natural disaster.
- Engineering construction protecting lands and industrial objects must be reliable and, at the same time, they should cause minimum environmental disturbances.
- Both state and public organization must be included in the flood control measures system. Successful work of this system must be direct and coordinated at the Federal level.
- A well functioning system of flood forecasting and announcing should be introduced in the country.
- There is a need in the flood knowledge popularization. All the State bodies and each inhabitant of the flood menaced territories must know what should be done BEFORE, IN COURSE and AFTER a flood.
- Control of flood menaced territories use must be a prerogative of Republics, territories, regions, districts and cities. The state can only stimulate their activities.
- An adaptable program of the insurance against the floods combing both the obligatory and voluntary insurance for the land use management within the flood-menaced territories is the best instrument. The principal position of this insurance is as follows: in the case of adopting a rational from the point of view of flood control land-use the insurant will be paid a much more sum than in the case of ignoring the corresponding recommendations and norms.
- It is very important to work out and to perfect the calculation methods of both direct and indirect flood damages.

THE PIPELINES EMERGENSY AT CROSSING OVER THE RIVERS AND METHODS OF ASSESSMENT OF THE OIL AND CONDENSATE POLLUTION EXPANTION

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According to our analysis of the accident statistics from more then 30-years of oil and gas-transport system development in Russia the majority of assidental failures happened at crossing swamps,peat bogs (i.e. soils with low bearing capasity), flood plains and beds of rivers. Severity of assidental failures at crossing through the rivers and flood plains about in 10 times more,then crossing other tipes of landscapes.

In "VNIIGAS" there has been completed a technique of pollution assessment including both the size of the oil (condensate) pollutant expantion on the ground territory (in winter period as well) and its penetration into water flows with different degree of a flow-rate. Simulation calculations of pollutant expantion under different conditions (flow volume and rate in rivers in different phases of a hydrological mode, the size of pollution etc.) enable us to develop a plan of attack in different situations.

Theoretical calculations can also locate the river spots most probable for oil or condensate infiltration which will enable us to properli define construction sites of the would be dams and weirs provided with oil traps and othes preventive measures.

Summary tables give (along with other characteristics) the pollution concentration levels in master entrances as well as the lengths of the most risky zones (graded in terms of MAC-maximum allowed concentration).

The technique presented has been verified on the data obtained after real accidents as well as on some other unbiased data. Presently the VNIIGAS is updating some items of this technique. Prediction calculated for a number of oil fields in the taiga region of Western Siberia (Tromyegan river basin) showed that the pollu-tants found in rivers as a result of pipeline fractures can potentially reach different master entrances in 1-4 days in flood-time of the year with the 50% water ensurance and in 2,5-9 days in the lowest discharge time of the year with the 95% water ensurance. Self-refining (purification) processes can decrease the oil content in flowing waters by 2-8% in flood-time of the year with the 50% water ensurance and by 3-19% in the lowest discharge time of the year with the 95% water ensurance.

Oil pollution zones in rivers having 3 MAC can expand as far as a few hundreds of kilometres in the flood time thus reaching the Ob ri-ver and spreading further down.

BIOEMULSIFYING ACTIVITY OF HYDROCARBON-OXIDIZING STRAINS AND ITS EFFECT ON OIL BIODEGRADATION IN WATER AND OIL

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Availability of hydrocarbons to bacterial cells is an essential factor affecting the bioremediation process in polluted waters and oils. In this respect chemical and biological emulsifiers may be of considerable promise. Greater availability of hydrocarbons to cells may be achieved through synthesis of extracellular biological emulsifiers. This in turn enhances utilization of hydrocarbons. The possibility of stimulation of oil biodegradation by indigenous microflora in bioemulsifier-treated water and soil samples has been also studied.

Twelve bacterial strains were analyzed for their ability to synthesize extracellular emulsifiers by using four tests. The degree of emulsification of hexadecane and Diesel fuel by these strains was an index of their synthesizing activity.

Six strains were found to be efficient producers of bioemulsifiers, while the rest one either had intermediate or no bioemulsifying activity at all. The data showed no evident correlation between oil-degrading activity of strains used and their bioemulsifying ability.

The effect of two extracellular bioemulsifiers on oil biodegradation in soil and waters was studied by using two strains. Bioemulsifiers added into soil and waters were found to accelerate oil utilization by natural microflora compared to a control. Biodegradation in soil treated with bioemulsifiers at concentration of 2 mg/g was in soil treated with hydrocarbon-oxidizing bacteria similar to that (10^7 cells/g).

The research was made in the framework of ISTC Project #119-95.

HIDROGEOLOGICAL MAPPING OF UNDERFLOOKING PROCESS IS A WAY TO ESTIMATE ECOLOGICAL HAZARD ON ASSIMILATED TERRITORIES

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In this country all built-up territories are exposed to underflooding. Since 1983 to 1993 underflooding areas increased twice and this process is developing. This developing includes not only increasing of process spreading area but also change of natural technogenic environment. Especially dangerous is the displaying of "unexpected" negative consequences. Detorioration of ecological situation plays the leading role among them, and if acquired catastrophical character. It confirmed by various factual materials.

Factual material was gathered and analyzed about more than 2000 populated areas in Russia and it allows us to speak about problem of underflooding on a country scale. the underflooding process is necessary to study with the help of hydrogeological investigation methods because underflooding causes technogenic change of underground hydrosphere. That is why, for realizing of wide and heterogeneous information about underflooding, offered very perspective method - hydrogeological mapping of underflooding processes. Method of the mapping is already elaborated. It consists of hydrogeological investigation complex of collection, generalization and studying of development underflooding features on regional and local level.

For the first time created cartographical underflooding models for Russia on a scale 1:5000000 and Kalmykia - 1:5000000. They present hydrogeological models of water change processes in "atmosphere - aeration zone - groundwater" system, which take into consideration various changes of natural condition under influence of technogenic factors on built-up territories and regions.

Review model of Russia is the base for the cartography and investigation of separate Russia regions. For example - Kalmykia.

Review cartographical model of underflooding Russian territories reflects: a) peculiarity of natural groundwater regime (re charge regularities in year cycle, structure and spreading of natural potential recharge); b) hydrogeological conditions of underflooding development (combinations of various materchange conditions, which determinate specificity and hazard of underflooding development); c) technogenic loading (it's spreading and intensity).

Smallscale cartographical model of underflooding region also reflects natural-technogenic environment and takes into consideration peculiarities not only natural, but also natural-technogenic groundwater regime. As a result of underflooding investigation in Kalmykia, exposed 52 populated areas which need priority underflooding protection, defined the main reasons of appearance and development of underflooding in it; suggested concrete structure of preventive and protection measures.

Suggest method of underflooding mapping (engineering hydrogeological substantiation, creating and studying of cartographical hydrogeological model of underflooding process) substance engineering protection and composition of measures, which can allow perfect territorial exploitation and improvement ecological situation. Created catrographical models is the base for arrangement following investigation to estimate development and activization of dangerous geological processes and their negative consequences, and first of all to estimate ecological hazard of contamination underflooding urban territories.

EXTRAORDINARY ECOLOGICAL SITUATIONS IN WATER ENVIRONMENT AND FISH

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Extraordinary ecological situation (EEC) in waterbodies are caused by factors dividing into two main groups: anthropogenic and natural. In both cases EEC are not over without leaving a trace for fish and provoke, as a rule, large-scale death of fish at different stages of development (eggs, larvae and young fish, groups of different age), which in the end adversely affects producers' stoke and catches. The typical special feature of EEC is in impossibility to foresee them and in this connection in suddenness of their beginning. This intensifies negative consequences of EEC for water ecosystems as a whole and fish in particular.

Among anthropogenic factors determined EES in waterbodies next ones have the most disastrous effect on fish:

– washouts (accident, accidental, premeditated) of different toxic substances and polluted sewage from industrial and agricultural works;

– petroleum-oil as a consequence of accidents of petroleum-oil tankers and oil pipelines;

– washing poison chemicals and other toxic compounds off into waterbodies with floods and rains on violating rules of their storage and use;

– sudden large-scale water draining out of reservoirs in connection with unforeseen need for electric power or in an emergency;

– fish overcatch on violating regime of fishery, etc. The main natural factors resulted in arising EES are next:

– sudden changes of water regime of waterbodies in connections of disastrous reducing (or increasing) flow volume;

– changes of water temperature regime (for example, the increase of water temperature far above the rate);

– mass manifestation of fish disease (parasitical, infectious disease, etc.);

– factors of nature (for example, Sartlan disease, etc.).

EES are able to take place in waterbodies of different types.

However they are more often marked in reservoirs in connection with their technogenic origin, intensive employment of water resources and, as a rule, high concentration of industry quite often. Reservoirs turned out to be the waterbodies of "the increased risk" for water organisms (including fish) owing to many peculiarities including frequency of EES rise.

Frequency of EES rise in waterbodies under the effect of anthropogenic factors may be reduced, and the negative effect on fish be lowered by accepted different preventive measures. These measures are made possible to a lesser degree for EES arised as a consequence of sudden natural phenomena.

Sizes of damages caused by EES to fish in waterbodies quite often depend on quickness and the extend of measure accepting for prevention of possible expansion of catastrophe and for neutralization of negative consequences.

The insurance should be marked among measures permitting to compensate negative consequences of EES. This fact must be mentioned, since in fishery of our country insurance action is almost not developed. which quiet often put producers of fish production in desperate situation.

Control of EES arising in waterbodies is complicated by high water dynamics (mobility). In the case of emergency getting into the waterbody, the proliferation of polluted and toxic substances, as a rule, defies localization and they are far from the place of throwing down in short time caused fish death and other negative consequences on the way of moving toxic front forward.

In this connection there are more hard nature-security demands to industry objects and other potential carriers of EES of anthropogenic origin situated on waterbodies or close by them to be used.

OIL UTILISATION IN MARINE AND FRESH WATER ENVIRONMENTS BY THE BACTERIAL STRAIN MYCOBACTERIUM SP. A1B

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A biological method involving oil-oxidizing microorganisms which use hydrocarbons as a sole source of carbon and energy is the most promising procedure for the cleanup of oiled water. The method is environmentally safe and cost-effective. However, no versatile techniques are presently available for the treatment of oil polluted water areas. In this context, the search for novel naturally occurring strains to be used for development of efficient techniques is becoming of high priority. This work deals with the selection of the strain A1b from samples of oiled sludge and marine water obtained within the aquatic site of the Arkhangelsk dockyard. The strain was isolated upon selective cultivation in a mineral medium supplemented with 0.5% oil. According to the Bergey's classification, this strain was attributed to the Mycobacterium genus. The ability of Mycobacterium sp. A1b to degrade oil in fresh water over a wide range of temperatures was studied. The quantitative analysis of oil biodegradation was performed.

The strain under research was found to be capable of oil degrading not only in fresh water but in marine one as well. Marine water -based studies at 25°C have shown oil biodegradation to be 51% in three days at the initial level of pollution of 0.3%, efficiency being 77%. The correlation between the results obtained and those from the studies of biotreatment of polluted fresh water has been established. Lowering of the temperature to 10 'C affected slightly the rate of oil biodegradation in both fresh and marine water samples. A Mycobacterium sp. A1b strain-based biopreparation for the cleanup of water environments are presently under development.

Activities have been implemented within the framework of Project #119- 95.

TECHNOLOGY, MATERIALS AND TECHNOLOGICAL EQUIPMENT FOR EMERGENCY SPILLS OF OIL-PRODUCTS QUICK ELIMINATION

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Elimination of emergency spills of oil-products is usually tied with great material and labor expenditure. But, usual methods of spilled oil-products collection don't ensure rather good surface-soil and water cleaning.

There are known Russian and foreign scientist's proposals about employing quick-sickening gels compositions for this purpose. It has come to our notice, that these proposals haven't been realized in real emergency situations owing to high cost and great consumption of gel-born materials, producing of which is rather laborious.

New material, assigned to quick localization and preventing of spreading oil-product spills with minimal labor expenditure, is developed by new technologies' laboratory of NPF "Dipole" in collaboration with the other leading specialists.

This material is fine granuled dry composition, which can be dispersed over emergency region, for example, by agriculture aviation, used for fertilizer spraying.

By contact with oil, dry granules of the material swell about tenfold, absorbing 10-12 times more oil then there own mass. There is formed coarse-grained gel-like substation. Over 30-50 minutes there will be no oil-film on the water surface. Gel-like substance can be collected by any mechanic process and machinery, for example by fine-mesh net or trawl.

After collecting, it is possible to extract the most oil fractions from produced gel and use them as oil fuel. Refined materials can be used for second collecting (with less efficiency) or as asphalt filling.

Proposed sorbing material, named Sorgel, contain no harmful or water-soluble substances, and it is ecologically clean. There are cheap raw materials, abundant in Russia, used for Sorgel production.

Necessary quantity for collecting purpose - 1 kg to 10 kg of spilled oil.

Time for full sorbing of oil (after using of Sorgel) - 30-50 min.

Tentative price of 1 kg of Sorgel by industrial production is about $ 3 US.

CREATION OF ECOLOGICAL PREPARATION LOCAL MANUFACTURES BASED ON READY FERMENTATION TECHNOLOGIES AND FACILITIES

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The create of the ready ecological preparations forms for utilizing various anthropogeneous environment pollutions and disposition of its production at scaly manufacture represents the conventional approach. Frequently extreme recession of pollution places or probable consumers of preparations, unregularity and non-uniformity of waste formation, an emergency reaction necessity - can make organization of flexible mini-manufactures in situ preferable (i.e. in regions of pollution formation) based on the enterprises - consumers. Advantages of such approach are also the transport expense decreasing, fresh, the most active preparation using, possibility of biomass application at once with a fermentation stage without further its processing and other.

So, for utilizing a wide petroleum-soiling spectrum (including mineral oils) intensive technology for associated Pseudomonas, Acinetobacter, Mycobacterium strains biomass production is developed. It allows to organize industrial scale using. There was developed enriched mineral media, temperature timing cultivation regimes, mode of the additives introduction, requirement to mass-transfer characteristics of the equipment, the process scaling up to reactors with 1 m^3 capacity. Grown cultures are successfully tested at oiling waters purification process in industrial conditions.

For using technology created fermentation facility is tested, in which reactors of various volume (at biomass preparing there capacities 0.1, 0.25 m^3) can be applied. The compact facility differs with: operationally simple communication structure, necessity only in 3 communications (water, air, steam), possibility of sterile process making, availability of an automatic control system, including blocks of mixing, thermo-stabilization, sterilization, control pH. The facility productivity permits to keep weekly recultivating of thousands m^2 areas (soils, basins). In experimental specimens biomass saved oxidation activity as an initial strain level. The facility is applicable for growing of a wide ecologically-active strains spectrum.

Thus, compact fermentation facility allocation in regions of environment pollution and the using of ready cultivation technologies can form the basis for in situ organization of polluted territories biological restoration.

WATER CRISIS AND POSSIBLE WAYS OF ITS OVERCOMING

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Nowadays many countries feel an acute deficits of fresh water resources. Mean while these resources are rapidly polluted. A problem of fresh water becomes the most important one in the world and stands before such global problems as the change of climate, soil salinization and erosion, preservation of ocean purity, degradation of the ozone layer, etc. It is stipulated by a special role of water in the formation of biosphere and life development.

Water crisis is connected not with the increasing consumption of water which is quite enough, but with its presistent pollution. Therefore, pollution is the main threat of fresh water. All this has already given rise to a very complicated problem of fresh water preservation and people's health and life connected with this problem.

To solve this grandiose problem one must realize the reasons which stipulated the crisis of man-water interaction, and all the people community with hydrosphere in the whole. In this situation one can name at least three reasons: 1) a thousand years belief in unlimited nature of water resources and their geologically eternal purity; 2) an inadequate understanding of the ground properties of hydrosphere and quite a special position of water on our planet which determined the development of the environment; 3) an imperfect realization of the fact, that a man, having become a geologic force, complicated qualitatively the interactions of the community and nature and especially hydrosphere.

To our mind, at present there appeared a principally new situation: water - the creator of life and the world around, today needs the human help more than ever. To preserve the basis of life one must struggle against the pollution of water environment, ensure its natural equilibrium and diversity, increase resources, protect water as the substance unique of our planet. This new situation requires a deep realization and fundamental change of man's attitude to water as an important component of the environment rather than natural resources of great value.

In connection with this, the accepted understanding of water as basis of life should be essentially specified; fresh water - is life, polluted water - is the danger of life. It is impossible that amount of fresh water on the Earth should reduce, but the number of pollution should increase. Today water is not already unlimited and innocuous natural resources as it was during millions of years. This reality must be deeply realized by all people.

The second main problem of the situation is that water is not already gratuitous natural resources, it demands large investments.

All previously said shows, that it is time to work out a principally new paradigm of hydrosphere preservation in the conditions of its application and strong technogeneous influence. Such paradigm should include ideas of water resources protection and preservation of water environment as the habitat of living organisms and the function if ways selection of the development of the system water-rock-gas-organic matter. This, in its turn, demands working out a conception of management of water resources, water environment and water ecosystems. At last, the paradigm of the preservation of hydrosphere should be built on a hydrospheric thinking or on the idea of hydrospheresofy by E.I.Slepian.

ECOLOGICAL EMERGENCIES IN HYDROSPHERE: DETERMINATION, TYPES, SIGNIFICANCE

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The hydrosphere is a relatively isolated in space and time quasiautonomous metastable morphopo etically monomolecular geosphere penetrating into other geospheres. It is genetically dependent on the

global biogeochemical cycle of water's molecules, capable of accommodating chemical compounds and transforming from one physical phase state to another. It represents the substratum of metabolism and is of concern as a habitat.

Ecological emergencies in the hydrosphere are the situations in aquatories (water bodies and water current) that are responsible for deteriorating their quality and the conditions inherent in them as in the physical habitat, for the disorder of the functions in ecosystems and for the destruction the latters. In water and round water ecosystems the hydrosphere's water masses are in inert and, when releasing from the destroyed living matter, a bioinert constituents, deparameterization of which causes the disorder in the ecosystem's biotic component and the ecosystem as a whole. The major manifestations of water masses deparameterization may be integrated into three types - primarily monofactorous, primarily bifactorous and primarily polyfactorous ones.

Primarily monofactorous manifestations of deparameterization are as follows: disgravitation, disbaria, acidification, disthermia, disoxigenation, disphotia, discinesia (laminarisation and turbolisation of currents), disvibration; primarily bifactorous manifestations of deparameterization are the following: dismagnetism (conditioned by the changes of magnetic and electromagnetic characteristics), diselectria (conditioned by the changes of electrostatic and electromagnetic characteristics); primarily polyfactorous manifestations of deparameterization are: dissedimentation, dischemia (including salination, mineralization of fresh waters and desalination, demineralisation of salt waters, and breakdown of the superficial molecular film as well), disradiation (disisotopia including).

Monofactorous, bifactorous and multifactorous manifestations of deparameterization may be both diachronous and synchronous ones, forming a set of dependencies. The potential follow-up of water masses (water habitat) deparameterization may be as follows: changes in mass- and energyexchange system (accompanied by the deviations in trophics - dystrophy, eutrofication, etc.), displacement of natural rhythms (disrhythmia, dischronosis), dehierarchisation of the super-organismal formations (trophodynamic chains including), differences in directionality of acclimation in producers, consumers and reducers, displacement of demographical processes, destratification (with changes in upwelling and downwelling), non-retention of hydrochemical and hydrophysical similarity and mosaicism of ecotopes, respectively, appearance of destruction, depression, depravation and cenosegregation zones in ecosystems, decay of ecotones, disturbance of water ecosystems as a whole with decrease in their ecorestoration potential.

An urgent problem is to determine the regularities of water ecological systems disturbance (hydroecoplagogenesis), regularities of water ecological systems restoration process (hydroecorestaurogenesis) and these processes control, substantiation and construction of the bioecological control system over the water ecosystems state (combining biotopic control, biotic control and complex control over the characteristics of ecosystems as a whole with preecoplagical and premorbidic diagnostics), substantiation and construction of the ecological protection local systems.

Taking place within the limits of the hydrosphere ecological emergencies may result in appearing (on the base of chain entwining processes regularities) the ecological emergencies in separate spaces of other geospheres contigous to the hydrosphere.

TYPIFICATION OF NATURAL-TECHNOGENIC ENVIRONMENTS FOR ECOLOGICAL ESTIMATING HAZARD DURING THE UNDERFLOODING OF URBAN TERRITORIES

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Underflooding is a result of a rise in a groundwater level and (or) an increase in water content of soils at the built-up territories conditioned by changing water balance (an income constituent of a balance increases due to additional infiltration alimentation) under the influence of a complex of technogene factors under specific environmental conditions. Underflooding leads to complication of construction and operation conditions of the built-up territory and to deterioration of the ecological situation. In Russia underflooding process is developing on all built-up territories.

The hazard of ecological consequences of underflooding can display not at once (during underflooding origin) but later and occupies large areas. The degree of environmental deterioration on urban territories depends on the sourse of contamination, it's intensity and hydrogeological process specifity in various natural geological conditions. During the underflooding on contaminated territories, begins the acceleration of poisoned components migration in clean groundwaters and aquifers, which serves water supply. Impact of formed highagressive groundwater on underground constructions and communication cause gradually destruction of buildings foundations, corrozion of metal constructions and intensive aging of water bearing piping and pipelines. So, increazing of losses from water bearing piping leads the development and activation of landslides, karst and other dangerous geologucal

processes. In dwelling houses with always underflooded cells, conditions of living become worser and increases the level of illnesses. Some district for individual building are unable for dwelling.

So, some underflooded built-up territories demand urgent measures of liquidation because of extraordinary situation (E.S.). This situation appears in cities and towns where the combination of inhabitan's concentration and dangerous technogenic impacts are most intensive.

Extraordinal situation is a result of technogenic change of hydrogeological conditions on urban territories. It characterizes by considerable economical, social and ecological concequences which involve damage of people's health and eclolgical concequences which involve damage of people's health and environment.

The most negative consequences of underflooding and their intercommunication clearly preseted in elaborated block-schemes.

In present time underflooded built-up territories and appearence of E.S. depend exclusively on short commings of town planning, engineering construction servey and territorial exploitation. The character of E.S. essentialy different, because the hydrogeological schemes of various environmental sistems are principly different. Typification of natural-technogenic environment elaborated for Russia towns which disposed out of permafrost soils.

This typification bases on our elaborated princips of hydrogological regionalization of groundwater regime features, which define the specific of underflooding development on redional and local levels and also it dases on hazard estimation criterions of underflooding development. As a result, typical hydrogeological visinities of urban territories were picket out.

This typification of natural-tecnogenic environment is necessary for elaboration of new normativ documents for engineering construction servey on underflooding territories and underflooding protection with estimating ecological hazard. Principle investigation of building design should take into consideration underflooding hazard and it's negative consequences. It gives the possibility to escape unnecessary economical and ecological losses.

ENVIRONMENTAL ASPECTS OF OILFIELD BRINES UTILIZATION

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About 5 mlrd. cub. m of mineralized water is annually pumped to the surface during oilfields exploitation. It is up to 90% of total amount of extracted fluids. In some cases this water is pumped back into aquifers to keep seam pressure. However, sometimes brines are placed in disposal ponds for solar evaporation (in arid areas), pumped into another aquifers, surface water flows or landscape. On application of back pumping there is a danger of accidents followed by spreading of brines on the surface. Damage of casing of disposal wells or surface pipelines is also possible. The presence of oilfield brines on the surface and in surface basins is most dangerous for environment. In this case there is a pollution of surface water and fertile soils, a leakage of brines to subsurface aquifers, which are often used for local drinking water supply. The danger of environmental pollution caused by brines is much greater than one caused by oil.

As a rule, oilfield water is s high-mineralized brine containing a number of toxic elements and compounds. Their concentrations are much higher than maximum permissible levels for household and drinking water supply. There brines usually contain some industrially useful components (Li, Rb, Sr). Their concentrations exceeds minimum levels for industrial extraction.

During comprehensive utilization of oilfield brines it is possible to extract both traditional components (B, Br, I, different salts) and above- mentioned elements and compounds. At present brines are not used on Russian iolfields, though in another countries (for example, USA) oilfield water is a significant source of raw materials.

Oilfield brines utilization is one of the best ways to prevent negative influence of iolfield exploitation on hydrosphere. Extraction of useful components makes oilfield water ecologically harmless when pumping to aquifers or surface disposal.

Oilfield in Russia occupy large area of great value. They are fertile soils, forests, unique ecosystems of North, thickly populated region. So, environmental pollution of iolfield is a state problem, especially in case of their possible privatization. Comprehensive use of oilfield brines should be obligatory during exploration of new areas perspective for oil and gas recovery. Only 1-3% of oifield brines are used, through total cost of useful components in 1cub. m of these brines is about $ 30-40.

The questions of oilfield brines utilization for water resources protection will be considered on the case study of Timan-Pechora province, where more than 40 perspective areas for oil and gas recovery were found.

ROUND TABLE

WATER RESOURCES QUALITY AND HEALTH OF THE POPULATION

ECWATECH

WATER, AGING AND LONGEVITY

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Together with SPU "Rele and automatika" collaborators we have developed a new project of human longevity, entitled "Water, health and longevity". The essence of the project is that polluted water is substituted in human organism for pure one with decreased content of deiterium and tritium. It is known that polluted water in the epoch of water crisis courses 70-80% of all diseases, increases by 30% the process of aging, After chlore treatment the water from water-pipe contains mutagens and cancerogens, which accelerate aging considerably, But even perfectly pure distilled water contains the damaging factors - deiterium and tritium. There are fractions of these isotope in pure water. For example one ton of river water contains only 150 g of heavy water, a ton of sea water - 165 g. There are scientific evidences about light-weight water with drawing from a man's body and heavy one D_2O delaying. If a man consumes 3 liters of water a day, he will pall through his organism about 8 tons of water with 1200 g of D_2O.

Deiterium and tritium injure the organisms of all plants and animals, the man including. Deiterium causes mutations, delays plants growth, results in premature aging and destruction, If 35% of light hydrogenium of water (protium - P) is substituded for deiterium the mammal will have died. Deiterium and tririum interfere with the normal metabolism processes, make an essential contribution to aging. Now we have found and study the universal system of water-structure regulation of life processes. It is possible to control man's aging, influencing this system. First we ran into this problem when we were investigating one of the longevity centers in the world in Yakutia. Yakutia climate is severe, there are no fruit and few vegetables. The only longevity factor there is thawed water and the Yakutians drink this water, obtaining it from the relic ice. This ice left there from the ancient time, when there had been little deiterium and tritium and the peoplt had been living for a thousand years according to the Old Testament.

We also studied other longevity centers in the former USSR: the mountain regions of Altai, Evenkia, Dolgano-Nenetski national district, Azervajian, Georgia, Armenia. We checked upon the longevity factor in India, China, Japan, Northern Korea. And everywhere old people have been using the glacier snow all their lives. The last is favorable enough to longevity because of its special structure and D and T low content. Birds drink this water while they are hatching nestlings. It is the relic water of the icebergs and glaciers in northern seas that provides plankton resources and great sizes of whales. The gigantic transforming dead and dangerous water into the water of life. Engineered in 1980s (patents of Russian Federation N2010772, 2031085 and oth.) the units VIN "Krinichka" were commercially produced by SPU "Rele and automatika" plants in Kiev. It gives 30-40 liters of curative drinking water. Chemical, microbiological and clinical analyses performed by the Central Sanitary epidemic station of Ukraine. The Ukrainian scientific hygienic center, show that the water has high quality, and meet all the existing GOST standards of drinking water. In addition it was found that this water does not contain mutagenic and cancerogenic factors. Owing to crystal purity, optimal microelements composition, high degree of order and other properties, the water from "Krinichka" exibits a powerful medical influence, confirmed by laboratory and chemical tests.

For the first time the evidences concerning geroprotecting, radioprotecting and antimutagenic properties of this water were revealed during our studies with drozophila. The water proved to be able to protect animals and plants genotypes. The obtained results agree with data reported by other researches. They are also in agreement with our views and maintain the concept of water-structuring life process regulation system in nature. Extrapolating the given facts to the man it can be expected that relic and VIN-5 "Krinichka" waters would exert the same effect on people. These waters can lengthen human life by 20-40 years including people living in polluted regions.

The next stage of our investigations became the development of deitirium and tritium content decreasing technology. The given technology and VIN "Nadia" units allow the production of water with half diminished content of these elements. This water displays more expressed radioprotecting, antimutagenic and rejuvenating effect than that from "Krinichka" units. So the age-long human dream of transforming dead water to water of life comes true.

ON ROLE OF WATER FACTOR IN EPIDEMIC SPREADING OF HEPATITIS IN THE UKRAINE

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Hepatitis A is known as a desease with the fecal-oral mechanism of transfer which is attributed to a group of intestinal viral infections. Realization of this mechanism is influenced by the water, food and daily contact factors of transfer. This influence has mostly an integral nature. It is known that the importance of the same factor can be different in different regions of the world.

The purpose of our investigations was a study of the role of each factors in the epidemiological spreading of hepatitis A infections among population. The epidemic process in case of hepatitis A is characterized as high intensive (sickness rate of hepatitis A is within the range of 500 - 1,000 per hundred thousands of population). Such epidemiological regularities as territorial unevenness and autumn-winter season in its annual cycle are typical of hepatitis A. The use of methods of the reaction of return passive hemagglutination and the immunoferment analysis for revealing of the antigen of hepatitis A virus, and the dot-hybridization of RNA-hepatitis A virus for revealing of the stimulant virulence marker made it possible to evaluate directly and properly the influence of different factors on the dynamics of the epidemic process. The results of our investigations prove that the population of cities and settlements with the centralized water supply systems use tap water contaminated by hepatitis A pathogen of various degree during a year, namely, less frequently and less contaminated water in summer and more often and more contaminated water in another 8 or 9 months in a year. The dynamics of changes in viral contamination reflected truly the character of seasonal fluctuations of the registered sickness rate of hepatitis A, mainly, at the expense of icteric types of hepatitis A infection. Besides, the higher was the level of epidemic activity of the water factor the higher was the level of sickness rate of hepatitis A in the region. In addition, no seasonal fluctuations were observed in the annual cycle of the epidemic process of hepatitis A sickness among children of 1 - 2 years old who use, as a rule, paseurized drinks and boiled water. It is not possible to judge on the fluctuations of a part of population susceptible to hepatitis A by his immunostructure (because the statistics was not authentic).

The conducted investigations have resulted in the data proving that the water factor is leading in the epidemic spreading of hepatitis A and that the uneven distribution of hepatitis A desease is conditioned by a degree of its epidemic activity. Besides, we were the first to prove authentically and properly the availability of relation between a degree of the clinical development manifestation of hepatitis A and a level of water viral contamination which determines the infection efficiency. The correlation is direct and authentic: $p = +0.9$ at $T^{\circ} > 2$.

The leading role of the water factor in the transfer mechanism of hepatitis A infection is determined, first of all, by the fact that water becomes a more important base of vital functions and health of man. The growing ecological trouble of the environment and the threat of the ever increasing viral contamination of water sources due to a great number of infection sources (against a high level of hepatitis A desease) and lack of efficient technologies for treatment and disinfection of public water have an influence, naturally, on the character of tendency to a growth of hepatitis A desease in the Ukraine. In its turn, this tendency is connected also with violations in the system of sanitary and hygienic measures, which result in intensification of environmental objects contamination, including aquifers, and with ecological exposure of water objects to uncontrolled conamination by enteropathogenic virus.

THE CASPIAN SEA TRANSGRESSION: SANITARY - EPIDEMIOLOGIC PROBLEMS

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The paper presents the materials of the study of medico-demographic conditions due to the developing processes of the Caspian Sea transgression. Unfavorable sanitary-epidemiological situation results from changeable hydrotechnical conditions, water quality degradation in water pools, complicated social situation in zones of underflooding and overflooding of populated areas, agricultural fields and objects of national economy. By the ratio of total assessment of the state of public health, the Russian areas (Dagestan, Kalmykia, Astrakhan region) refer to unfavorable ones. High levels of intestinal and parasitic sick-rate have been revealed which are directly linked with water factor and dominate in overall spectrum of nosologic forms, especially in coastal areas.

Expert analysis for the reasons of non-infectious diseases of cardio-vascular, nervous and secretory systems, genetic disturbances and cancer diseases displayed a dominating role of direct and indirect impact of water factor. Expert analysis of further negative development of environmental medical situation in a zone of sea transgression impact is given and environmental medical after-effects of the use of various hydrotechnical protective facilities are considered. Their environmental medical inefficiency is shown and measures aimed at elimination of unfavorable after-effects of the sea transgression for sanitary living conditions and the state of public health are substantiated.

BARRIER FUNCTION OF WATER-TREATMENT PLANTS IN RELATION TO REMOVAL OF VIRAL CONTAMINATION OF WATER FROM SURFACE SOURCES OF WATER SUPPLY

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It is known that water becomes more and more limiting factor in the life functions of man with every coming year. It is clear, therefore, why the requirements are so high for drinking water quality specified by State Standards of individual countries and by documents of the World Health Organization.

Provision of epidemic safety against both bacterial and viral infections is one of the main requirements placed to the drinking water quality by State Standard 2874-82 "Drinking Water". In its turn, epidemic safety is characterized by absence of infectious diseases pathogens, namely, microbes and virus in purified and disinfected water.

Efficiency of current technologies of water treatment and disinfecting used at water-treatment plants in seven big cities of the Ukraine (Kiev, Dnepropetrovsk, Simferopol, etc.) was studied in the full-scale conditions in relation to the removal of enteropathogenic virus (hepatitis A virus, erysipelas virus and enteritis virus) from water of surface sources water supply and provision of population with epidemically safe water for domestic and drinking needs. Modern methods of investigations were used, such as virologic, radioimmunal analysis and immunoferment analysis, reaction of return passive hemagglutination, microbiological, physicochemical methods and methods of molecular biology (dot-hybridization RNA). For a preliminary concentration of virus from 10 - 100 litres of water the methods of sample treatment by bentonite (concentration 10^3 - 10^4 times) was used, and treatment by immunosorbent of special purpose was also used with consequent indication of viral antigens (hepatitis A virus and erysipelas virus) on the solid phase (concentration 10^7 times) in accordance with the methods developed by the authors, which made it possible to determine the presence of 1 - 10 radioimmunal and immunoferment analyses for 3 - 4 orders. After multiple and repeated investigations of water sampling during the technological process of water treatment by using coagulant (sulfate of aluminium) and sandy-carbon filters and after disinfection of water by chlorine, it was established that the modern technology of open reservoir water treatment used at water-treatment plants in the Ukraine was not efficient as regards removal of enteropathogenic virus. For example, hepatitis A virus was determined in tap water supplied to population with the frequency of 12.0%, 38.0%, 60.5%, and its concentration in 10 - 100 litres varied from 10^7 to 10^{12} viral particles. The coagulation process (the main stage in the process of virus removal) proceeds efficiently in the conditions of the Ukraine only in 3 - 4 summer months at the temperature of water above +11...+15°C. In other months of a year (8 - 9 months) at the temperature below +10°C coagulation of water does not take place, and, as a result, epidemic danger of tap water increases still more. It is necessary to substitute the current technologies of water treatment and disinfection by more efficient technologies which will exclude the presence of enteropathogenic virus in drinking water.

THE TOTAL MUTAGENIC ACTIVITY (TMA) OF DRINKING WATER AND METHODS OF WATER TREATMENT

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The association the by - products of chlorination with increased risk of bladder and rectal cancer was shown. Terefore the assassment of mutagenic and carcinogenic activity of drinking water chemicals and carcinogenic activity of drinking water chemicals is actual problem. TMA (the mutagenic potential of organic chemicals water polupion) is the integral and efficient index for control of mutagenic and carcinogenic activity of drinking water chemicals.

It is Known, that TMA of drinking water from surface water sources caused by mutagenic halogen organic substances, formed from non mutagenic organic compounds (mainly humic substances) of raw water during chlorination process. Therefor it is important to assess the influence of different disinfectants under various regimes and combinations as well as coagulants and floculants on TMA of drinking water from surface water-sources.

Experimental studies were carried out on pilot drinking water plant with Volga water-source. The treatments by various doses of chlorin and ozone, separately and in various combitations, were used. The tested water (160-200l) was passed through column with polymer sorbent Separon SE . Then sorbent was taken out, dried and chemicals were extracted by acetone. The elueate was evaporated

to dry residue, wich was dissolved in 1,5 ml dimethylsulfoxide. Mutagenic activity was assayed by Ames test using TA100 and TA98 strains of Salmonella typhimurium withuot and with metabolic activation (MA- and MA+). Initial concentrate and its dilutions 1/5 and 1/25 were tested.

As the indices of TMA were double volume (DV) - the volume of water increased the quanlity of revertant colonies two times compareted the control level and the number of revertants colonies per 1l equivalent dose (IKR), calculated from the linear proportion (initial slope) of dose-response curves.

The samples of water without tretment were not mutagenic. Clorination induced the TMA in all strains/variants, especially with TA100, MA-. The level of SMA increased with increasinol of chlorin doses. Ozone under ozonation or ozonflotation did not induced TMA of water. Ozone in dose 0,5 mg/l significantly decreased induced chlorination (dose of chlorine 2-4 mg/l) TMA of water. This decreasing effect was less as the ozone dose was 3,8 mg/l. Ozonoflotation was less effective in relation TMA lowering, induced by chlorine as compared with standard ozonizing. The pretretment of water by ozone befor chlorination also decreased the TMA of water.

The influence of other desinfectants (chloamine, chlorin dioxide, hypochloride, hydrogen peroxide) on water TMA was studied.

This data allow to do conclusions that using combination chlorine and ozone can essentially decrease the level of mutagenic substances in drinking water.

WATER QUALITY AND THE PROBLEM OF THE POPULATIONS HEALTH PROTECTION

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Statistic reports data analysis testify to the steady unfavorable quality of drinking water in communal water pipe- lines in the Russian Federation.

In 1995 the situation continued to detertiorate, and discrepancy between drinking water quality and the existing GOST 2874-82 on the average in the country

reached 28.7% according to chemical and 11% according to bacteriological indices. A still more alarming situation is observed in departmental water pipe lines and decentralized water supply. For example, in the Kaliningrad area deviation from hygienic reqirements was observed: according to bacteriological indices in more than 30 and 70% of the tested samples respectively, and according to chemical indices - in more than 50% of samples. A most critical situation is observed in the Pribaltic, Far Easten and Northern regions. In the Smolensk, Kaluga, Astrakhan areas and in the republic of Kalmykia 17.2% - 40.1% of water samples did not meet the existing criteria of epidemiological safety. Water quality in rural areas was characterized by worse indices as compared to urban areas. Among the widely spread and most serious anthropotechnogenic pollutants viral, parasitic, bacterial contaminations were observed, as well as heavy metals, chlorine-containing hydrocarbons, pesticides, low levels of fluorine and iodine in drinking water received by the population was also observed.

The unfavorable quality of drinking water can not only result in limitation of its consumption due to unfavorable organoleptic (aesthetic) properties, but it is also one of strong reasons of the negative influence of chemically and biologically contaminated water directly on the health of the population.

As far as epidemic safety is concerned, the most urgent and regressing, especially in rural areas, is water-born bacterial dysentery and viral hepatitis A. If in 1992 16 water-born outbreaks of acute intestinal infectious diseases were observed, including dysentery, with the total of 2457 people suffered, in 1993 there were 21 outbreaks (2992 people), in 1994 - 25 (3040 people), and in 1995 - 32 (20 of them were outbreaks of acute dysentery), in which 4823 people suffered, i.e. during the lasr 3 years their number became twice as high. If in 1995 the average hepatitis A morbidity rate (in cases per 100 thousand of the population) was observed on the level of 123 (11.3% higher than in 1994), in subjects of the Federation where supply of epidemically safe drinking water is a serious problem, it was significantly higher: in Karachaevo-Cherkessk Republic - 474, in Stavropol region - 273, in Perm area - 266, in the Republic of Sakha-Yakutia - 242, in the Northern Osetia - 233. Alongside with serious breaking of rules of maintenance of the main water lines installations - like absence of the necessary complex of treatment facilities (e.g. up to 67-100% of rural water pipe-lines in Yakutia, Karelia, the Murmansk, Tumen, Kaliningrad areas) and disinfecting devices (e.g. from 68 up to 83% of water pipelines in Yakutia, Karelia, the Tumen area, compared to the average indice for Russia 8.2%),one of the most important reasons of water-born infections is secondary contamination of water in the water pipeline network.

Out of chemical factors in the Russian Federation during the last ten years the influence of increased fluorine concentrations in drinking water on the development of dental fluorosis was observed (e.g., Nadvoitsi, the Republic of Karelia, Mordovia), chlorides and sulphates - on the de-velopment of cardio-vascular and intestinal diseases (Povolzhie), nitrogen- and chlorine-containing compounds - on the development of chronic nephritis and hepatitis, toxicoses of pregnancy, congenital abnormalities of

development (Kemerovo, Yurga), nitrites - on the blood-formation function (Lipetsk), aliminum - on the central nervous system and immune status of children (Malaya Vishera of the Novgorod area), chlororganic hydrocarbons - on the development of toxic poisonings (Ufa, Orenburg, Chapaevsk of the Samara area, Tumen) etc. Another serious problem is insufficient intake with drinking water of a number of biogenic essential elements - more than 80% of the population of the country live in the situation of fluorine and iodine deficiency, which is one of the major reasons of the increase of development of dental caries and goiter of the thyroid gland.

The observed relationship between drinking water quality and health of the population predetermines the necessity to make requirements to sanitary protection and sanitary-ecological monitoring of the status of water sources for drinking purposes - more stringent, to eliminate drawbacks in the maintenance of water pipe-lines and further modernization of technologies for disinfection and treatment of water, the necessity of strict adherence to the rules of building and maintenance of the water pipe-lines network, the necessity to use portable water treatment devices of "rapid reaction" under the negative exposure of the population to drinking water.

UP-DATING OF CRITERIA OF DRINKING WATER EPIDEMIC SAFETY ACCORDING TO BACTERIOLOGICAL INDICES

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The problem of standard-setting for quality of house-gold and drinking water supply according to microbiological indices is of the wain problems in the sistem of preventive sanitary surveillanse. In accordance with the State Standard - GOST 2874-82 "Drinking water" standards were set for a large group of representatives of enterobacteria acting as enzimes for glucose, the number of which should not exceed 3 in one litre, was taken as the main indicator of epidemic safety of water. The hygienic reliability of this criteria was scientifically based and confirmed through many years of practice.

Hawever, standards developed by WHO, ISO and other cantries differ from those adopted in our GOST, since approaches to standard- setting for bacterial contamination are different , in particular the difference being in measurement units in 100 ml, principles of standard- setting based on the absens in the tested water volum - which is more safe from the hygienic point of view, tests of identification of the indicatory group of coli bacilli according to the lactose component. All this makes in impossible to compare drinking water quality assessment results according to bacteriological indices obtained in this country and abroad. Besides, the existing in this country documents contain information of standard setting in the water of water-supply sources and drinking water for various groups of coli bacilli, which compers assessment of the efficiency treatment facilities functionning, new methods of water preparation and desinfection of house-hold water treatment equipment, ets.

Therefore, coliform bacteria (lactose-positive coli bacilli), i.e. a more narrow compared to the commonly used group of bacteria of the coli bacilli type, were suggested to be considered in the development of new regulatory documents Sanitary Rules and Norms and GOST on drinking water quality. 100 ml instead of 1 liter was recommended as a unit of measurement. The absence of coliform bacteria in 300 ml of tested water is used as a criterion of water quality assessment according to this indice. Thermotolerant fecal coliform bacilli, differenciated from the general group of coliform bacilli using a temperature test, were recommended as an additional indicator of fresh fecal contamination.

Alongside with the index "coliform bacteria", standards are also set for the total microbes count (TMC) as an integral indicator reflecting drinking water contamination with all bacteria growing on the nutritional agar at T - 37° C, the number of which should not exceed 50 cells per 1 ml.

The suggested indicators and standards were scientifically substantiated on the basis of many years of studies on the relationship between indicatory with pathogenic and conditionally pathogenic bacteria, as well as according to the influense of different levels of bacterial contamination on morbidity of the population with intestinal infections. The data obtained has shown that the suggested standart was accepted with account for the main hygienic priciple of the necessity of sanitary margin and will ensure epidemic reliability of drinking water quality control. Selecting a more narrow group of indicatory bacteria does not decrease the reliability of results since more stringent requirements have been suggested (absence in 300 ml) compared to the existing ones which allow one cell to be present in 300 ml. The new version of the microbiological section of Sanitary Rules and Norms has been discussed and adapted by the leading experts of Moscow at the meeting of the sanitary microbiological unit.

METHODOLOGICAL BASES OF STUDING OF THE INFLUENCE OF DRINKING WATER CHEMICA CONTENT ON HEALTH STATUS OF THE POPULATION

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At present one of the most urgent trends in environmental health development of methodology of determination and prediction of quantitative relationships between the degree of influence of existing in reality combinations of harmful environmental factors (real anthropotechnogenic chemical, biological and other types of burden on the organism) and health status of the population.

Improvement of methodology of studying and quantitative assessment of the effect of the water factor, and, in particular, drinking water chemical content, on human health is one of the obligatory components of comprehensive analysis of the relationship between environmental factors and health status of the population.

Results of our studies and literature data analysis have shown that the principle methodological scheme of field studies on the relationship between drinking water chemical content and health status of the population should include the following stages of investigations:

- study of the conditions of formation of the water of a water source for drinking, including the characteristics of its sanitary protection zones, primary and secondary sources of contamination, assessment of the dynamics of water quality according to years and seasons - with the aim to classify the source of water supply in accordance with GOST 2761-84 and determination of a list of additionally controlled parameters of drinking water quality (I stage);

- thorough study of drinking water quality in the previously selected settlements in accordance with the latest WHO recommendations (1993) and SanPiN's (Sanitary Rules and Norms) draft "Hygienic Requirements to the Quality of Water of Utility-Drinking Water Supply (1995), as well as on the basis of biotests results on hydrobionts and Ames test (determination of the total mutagenic activity) and calculated differentiated integral and complex indices - with the aim to range drinking water quality according to the degree of the possible risk of unfavourable influence on the organism taking into account the allowable 24-hour intake doze.(II stage);

- selection of models "copy - pair" to isolate health effects of the drinking water factor (various settlements with differing drinking water quality , the rest environmental factors being equalized; one and the same settlement with different water quality in its different parts; detection of population groups with the altered conditions of water supply (household water treatment devices); detection of population groups with prophylactic sanation (house-hold conditioners) - to substantiate the type and method of an epidemiological study, cohort sampling, sample size, units, time and depth of surveillance (III stage);

- deeper study of health status, including the analysis of demographic parameters and cause-related total morbidity of the population, as well as results of a purposeful examination according to prenosological diagnosis indices with an early detection of premorbid states, on the basis of which the characteristics of the examined population is given according to health groups, health status indices associated with the factors under study are determined (IV stage);

- establishment of the quantitative relationship between drinking water quality and health status of the population using statistical methods of analysis (method of group consideration of arguments, correlation, dispersion, regression analysis) and a complex pathogenetic analysis - to identify the degree and character of the influence of the studied drinking water quality parameters on health of the population and their hygienic ranging, scientific substantiation of the program of studying of the input of the water factor into the total (real) chemical burden (V stage).

THE WATER AND HEALTH: ECOLOGO-HYGIENIC' PROBLEMS OF WATER-SUPPLY OF THE TRANSPORT

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The development of major task of hygiene of transport - preservations of health of specialists and passengers - closely interaction with decision of problems of minimization of influence of factors of system "the transport - person - environmenty". One of such factors is drinking water, for the means of transport render the expressed influence on condition water sources, and on means of transport even good-quality drinking water acquires the negative properties.

With the purpose of research of tendencies of change the canitary-hygienics of parameters of quality of water from sources of water-supply of objects of transport is produces retrospective (1988-

1994 yy.) analysis more than 50 these parameters in running water four towns of Ukraine, being units transport: railway, air, marine or river. Made by methods discriminant' of analysis complex ecologo-hygienic the valuations of quality running water has demonstrated statistically authentic ($p<0.05$) distinction between 1988, 89 and 1993, 94 yy. for all investigated of towns. The study of tendencies of temporary shift of complex sanitary-hygienic of parameters of quality of water by way separation - with help of criterion of additional information - the most significant from them has shown, that the heaviest weight in change of mentioned valuation introduces the increase in due course of concentration of series of heavy metals, as well as sulfates and nitrates (at minimal change of the common mineralization). The valuation of tendencies of change sanitary-microbiological parameters of quality running water has demonstrated, at relative prosperity of parameters, designation's GOST 2874-82 (total number of microorganisms and index BGKF), increased of the frequency of pollution of it viruses and pathogenic elementary ones.

Above-stated permits to thick, that the adequacy sanitary-hygienic and technological regulations of conditioning of water in systems of water-supply and water-drain on transport should and can be evaluated on basis of efficiency state hygienic monitoring, conducted by experts sanitary-epidemiological of service of transport. The base for complexion of tasks hygienic monitoring are acting and developed normative-methodical documents, regulations three above named aspects of water-supply, training-methodical allowances for experts of transports and medical-sanitarian service on transport, and criteria their utilities - optimization of condition of environment, decrease disease of specialists of transport and passengers, including - infections and causality connected with water.

THE CONCEPT OF CONVERTING TECHNOLOGY OF THE LIFELESS WATER TO WATER OF LIFE

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Legends and myphs carried to us the age-long people's dream of the water of life, capable of curing diseases, giving people youth and immortality. The dream is the echo of the time when drinking water on the Earth was crystal clear, contained little deuterium and tritium, had the structure of ice and melted water. At that time there were gigantic plants, enormous animals. The relic water preserved only in the form of ancient ice. Our studies of treating-prophylactic by us the treating-prophylactic properties of this water at the Tomsk medical institute in 1960 - th years confirmed its high biological efficiency. They prompted us to research into the relic water manufacturing technology.

These pioneering investigations could not be carried on because of the difficulties in transforming relic ice from Yakutsk to Tomsk. The work was resumed in Kiev. Here famous scientific schools of academicians L.A. Kulski and N.S. Davidov work. It was in Kiev that the unique technology of water obtaining have been designed. This water has thawed water structure and the amount of D and T below normal one by 25 %. One of the authors doctor I.N. Varnavski succeeded in designing new unit VIN "Krinichka" for that goal. The task turned out-to be very complicated because the water from water-pipe after chlore treatment has thousands of mutagens and cancerogens and only 9 stable isotopes out of 36. Some scientists call this water "liquid Chernobyl". It was necessary not only to get rid of all cancerogens and mutagens completely, but also to erase the least structural memory of their presence. It was necessary not only to remove all cancerogens and mutagens completely, but also to erase the least structural memory of their presence. We had worked hard to develop efficient filters to retain all mutagens, cancerogens, elements of heavy metals, the methods and the devices of erasing structural memory of toxic compounds, dissolved in water, the methods of imparting of the icy thawed water structure to the water from water-pipe. Besides, it was important to work out the technology of enriching this water with microelements, especially with F, I Ca, Mg and P in appropriate proportion. Then it was required to provide the water with the stable isotopes of Cs, Sr, Pt, to wipe out the Chernobyl radionuclids from the organisms of people living in Belorussia, Russia, Ukraine polluted regions. But the most important was to decrease deuterium and tritium content in drinking water disturbing life processes. At last a group of Ukrainian scientists from the International association "Water and health" designed the technology and the units capable of transforming dead and dangerous water into the water of life. Engineered in 1980 (patents of Russian Federation № 2010772, 2031085 and other) the units VIN "Krinichka" were commercially produced by SPU "Rele i automatica" plants in Kiev. It gives 30-40 liters of curative drinking water. Chemical, microbiological and clinical analyses performed by the Central Sanitary epidemic station of Ukraine, the Ukrainian scientific hygienic center,

show that the water has high quality, and meet all existing GOST standards of drinking water. In addition it was found that this water does not contain mutagenic and cancerogenic factors. Owing to crystal purity, optimal microelements composition, high degree of order and other properties, the water from "Krinichka" exhibits a powerful medical influence, confirmed by laboratory and chemical tests.

For the first time the evidences concerning geroprotecting, radioprotecting and antimutagenic properties of this water were revealed during our studies with drozophila. The water proved to be able to protect animals and plants genotypes. The obtained results agree with data reported by other researches. They are also in agreement with our views and maintain the concept of water-structuring life process regulation system in nature. Extrapolating the given facts to the man it can be expected that relic and VIN-5 "Krinichka" waters would exert the same effect on people. These waters can lengthen human life by 20-40 years including people living in polluted regions.

The next stage of our investigations became the development of deuterium and tritium content decreasing technology. The given technology and VIN "Nadia" units allow the production of water with half diminished content of these elements. This water displays more expressed radioprotecting, antimutagenic and rejuvenating effect than that from "Krinichka" units. So the age-long human dream of transforming dead water of life comes true.

MATHEMATIC MODELING OF WATER QUALITY INFLUENCE ON CHILDREN HEALTH

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The harmful influence of environment ecological factors displays by the development of pathological reactions from organism side and increased level of population disease formation.

With the aim of mutual ties reflection in "environment - population health" system the children health from 2 pediatric regions, based in pollution zone of one of Perm chemical enterprises was familiarized by the personal maps of development for the 10-years period. More than 2000 maps were analyzed.

The informational data bases on the water quality and atmosphere with every month middle period were formed during this term.

The informational picking was conducted according the "Order of sanitary-epidemiological service activity on the population health condition estimation because of the environmental factors influence. M.1988".

Accumulation of information, correction, processing, analysis and reflection were passed within the elaborated automatic working place with the help of personal computer technology of IBM PC/AT type with the standard applied programs use (SAS V 6.04, STATGRAPH and other).

Mathematical modeling of mutual ties change of children health and environment quality was made with multitude regression model use, allowed to reflect the ecological caused pathology types, to established the correlation level (R^2) and ties authenticity (F).

There was established that the ecological dependent pathology types are the breath organs diseases (respiratory diseases, nosofaringit, rinit, bronchitis, pneumonia); gastric-digestive tract (stomatit, gastrit, doudenit, liver diseases); allergetic appearances (dermatitis, neurodermit, allergetic reaction, diates); some infectional diseases (smallpox, measles, parotit, German measles).

The most significant influence factors of water descent are chlorinefenol, oxidation, chlorides, remnant chlorine, muddle, alkaline, common rough Ca, remnant Al.

The high level of correlation (R^2>0.150 and significant model authenticity (F>4.0) determine firstly the formation of respiratory-virus diseases, pneumonia, gastrit, doudenit, stomatit under the influence of ecological factors of water descent (table).

Table.

Children ecologically caused pathology and factors of ecological risk of water descent.

Pathology types	Water factors	Statistic parameters	
		R^2	F
Respiratory-virus infection	remnant Cl, clorinefenol	0.67	18.6
Pneumonia	remnant Cl, chlorides	0.3	13.78
Gastrit, doudenit	remnant Al, Mg, Fe	0.196	18.51
Dermatitis, neurodermit	muddle, remnant Al	0.19	9.61
Stomatit	oxidation, sulfates	0.18	5.46
Measles	remnant Al	0.169	

The less clore correlation was marked between the liver diseases and remnant Cl content: German measles and remnant Cl; otit and nitrates, remnant Cl, gypertonia and nitrates, remnant Cl.

Thus, the ecological factors of water descent cause the pathologic states development and functional changes of the whole row of organs and organism systems.

Mathematical approaches to the mutual ties modeling of the environment and children health allowed to established not active factors parameters by the children health criteries.

ASSESSMENT OF TOTAL MUTAGENIC ACTIVITY (TMA) OF MOSCOW WATER SOURCES.

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The control of mutagenic content in water sources is the actual problem of water hygiene and ecology. A level of (TMA) of organic pollutants in raw water is the effective bioindicator its quality allowing to perform rapid testing of water contamination with mutagens/carcinogens. The most widespread method of TMA assessment is the analisis of water chemicals concentrates in Salmonella/microsomes assay (Ames test).

During 1992-1994 the TMA of Wolga and Moscow river raw water were studied. The water samples (50-120 l) were passed through the column with polymer sorbent Separon SE (TESSEK, Prague). Then sorbent was taken out, dried and chemical pollutants were eluted by acetone. The elueate was evaporated to dry residue, wich was dissolved in 1,5 ml dimethylsulfoxide. The concentrate was diluted to 5 and 25 times. Mutagenic activity of concentrats was assayed by Ames test using TA100 and TA98 strains of Salmonella typhimurium withuot and with metabolic activation system. The tested doses of chemical concentrates and its dillutions corresponded to 1/15, 1/75 and 1/375 of water volume passed through the column. The 24 raw water samples were tested from each water sources.

The rate of water samples with TMA was 12,5% in Valga and 58,3% in Moscow river. The minimal effective volume (the minimal water volume, showed significant mutagenic effect) in positive water samples were 5 l and more. The TMA of raw water in Volga and Moscow river may be classified as weak. The positive effect were found manly on strain TA98. The similar investigation on Czech water sources shouwed the rate of positive samples from 59% to 94% (M. Cherna et al, 1991). The raw water of Volga source is polluted by mutagens essentialy less, than water of Moscow river. This data show on necessity of permanent control of work of municipal and industrial water - treatment installations.

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Third International Congress

and Technical Exhibition

«Water: Ecology and Technology»

ECWATECH - 98

Moscow, May 25-30, 1998

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